THE 20 BEST FREE GAMES
Save your cash for cutting-edge hardware

NVIDIA'S NEW BUDGET CARD TESTED
Is the GTX 950 the new dream card at 1080p?

ASUS MAXIMUS VIII HERO RATED
Could this be the best Z170 motherboard yet?

FINAL ISSUE!

PERFORMANCE GEAR & GAMING
PC Format®
ISSUE 310 • NOVEMBER 2015

POWER UP WINDOWS 10

- ✓ 73 power tips and tricks from the experts
- ✓ Master the new OS with vital hidden settings
- ✓ How to fix installation problems

COOL IT!
Custom build the ultimate water-cooled gaming PC

BUILD IT!
WINDOWS 10 GAMING PC FOR £463

PLUS The ultimate PC buyer's guide

Future

Cyberpower recommends Windows.

Windows 10

One experience for everything
in your life.

CYBERPOWER

Unleash The Power

Create The PC of Your Dreams

Cortana available in select markets at launch, experience may vary by region and device.
*External monitor must support HDMI input. [If Continuum-compatible accessory is not included, add: "Accessories sold separately."] **App availability and experience varies by device and market. Office 365 subscription required for some features. ¹Limited to select premium phones at launch.
Feature and app availability and experience may vary by market and device.
Windows Hello requires specialized hardware, including fingerprint reader, illuminated IR sensor or other biometric sensors.

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Windows 10

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Alan Dexter,
Editor

A FOND FAREWELL

LET'S START with a little insight into magazine production. At least when it comes to *PC Format*. The Ed's intro is always the last thing that is written. I sit down to write it just before, just on, or sometimes, just after deadline (sometimes we're late). By the time I'm writing it, I'll have checked and read everything in the magazine and be stoked by what's in the issue. Keen to highlight the best bits first. Excited about how brilliantly written the articles are, how interesting they are and how entertaining Luis and the back page are – as they always are.

This issue is no different in those respects. The Windows 10 cover feature is packed with tips and tricks to help you master Microsoft's new OS. A lot has changed with Windows 10, so a good rummage around by our writers has found lots of interesting things that are worth getting to grips with. Likewise, the water-cooling feature is insightful, inspirational and entertaining. We were so impressed with the final build that we used it for this month's centrefold.

Our take on the best free-to-play games should ensure that you're not at a loose end on the gaming front for some time to come. There's bound to be a few games that you don't know about in there – there were certainly a few I didn't know about. And, on top of all that, we've got reviews of the latest kit and games, plus plenty of tutorials, as well as the aforementioned "Ask Luis" – this issue focusing on installation woes concerning Windows 10.

What's different this issue is the fact that between starting the magazine and finishing it, we've been informed by the powers that be that this will be the last issue of *PC Format*. The bean counters have moved around their little seeds and declared that something doesn't quite add up anymore. Something needs to give, and unfortunately, it's us.

And so it is with incredible sadness that I have to say farewell to you all. I've been on the magazine since issue 195, and helped out on various articles long before that, so being the editor that closes the magazine is particularly emotional. I've worked with some incredible people to publish the title over the years, and the current team is just as brilliant as it ever was.

Whether this is your first issue of *PC Format*, your tenth, or your 310th. Whether you've bought every issue or just dipped in now and again to see what's happening in the world of PCs over the last 24 years. I thank you for joining us on an incredible journey, and I wish you all the very best in whatever and wherever you go next.

As for the *PC Format* crew, we'll continue to punish the latest hardware and find the best ways of squeezing more frames per second out of the latest games over on sister titles *Maximum PC* and *PC Gamer*. So if you want to keep up to date with the latest hardware, then we'd recommend either (or both) of those publications. Hopefully we'll see you there.

Alan Dexter, Editor

↘ Thanks for the memories: alan.dexter@futurenet.com

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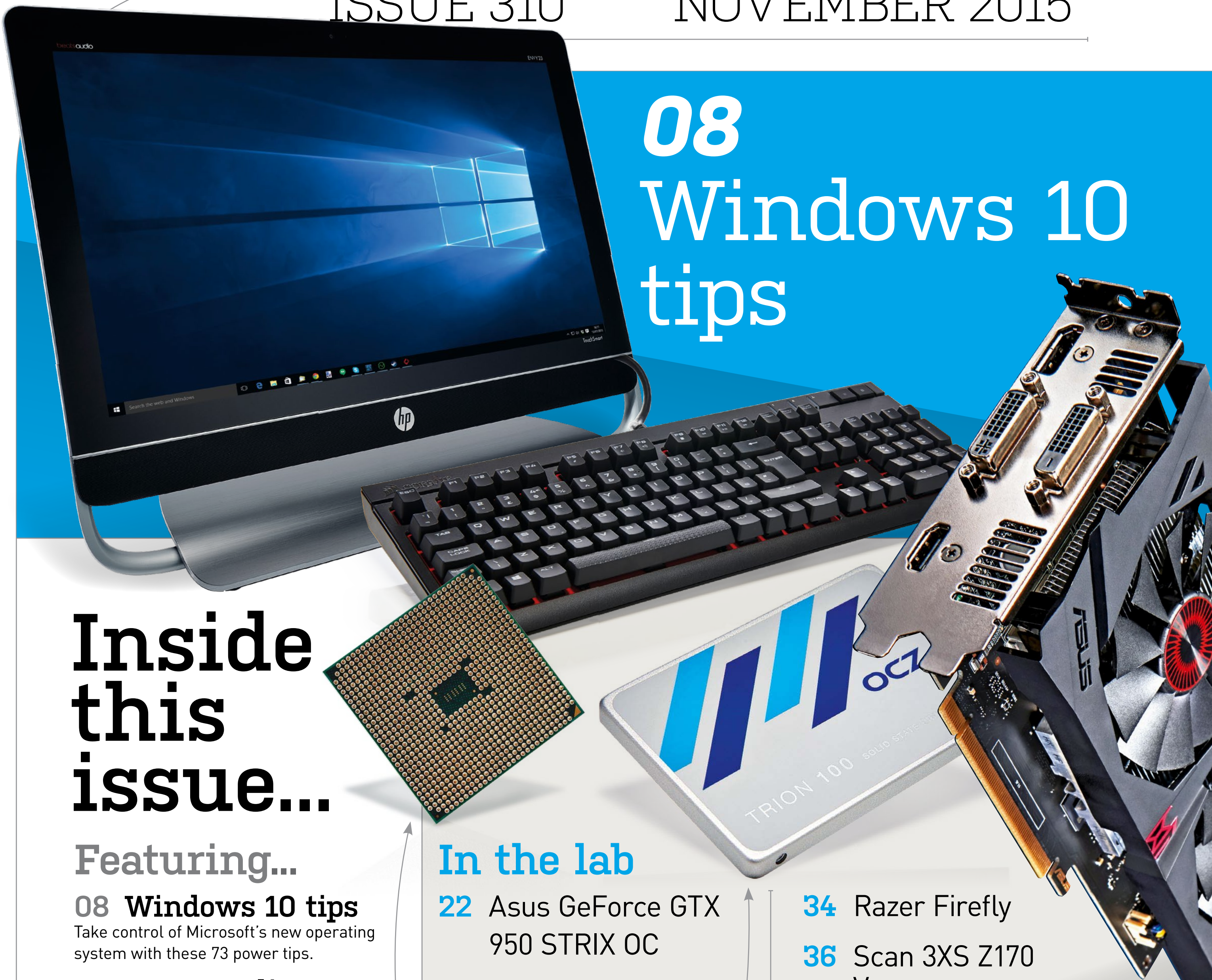

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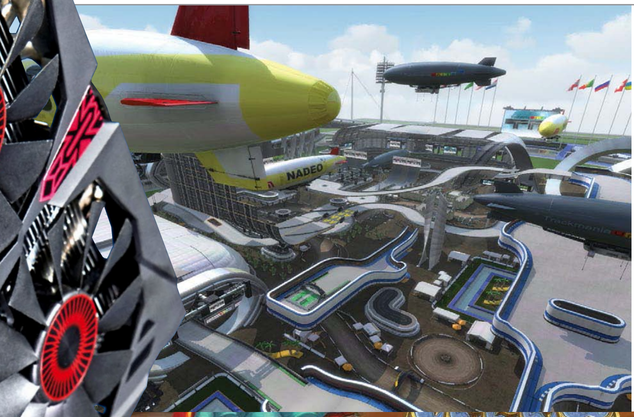

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73 POWER TIPS FOR WINDOWS 10

All the expert help and advice you need to master Microsoft's new operating system

BY MAYANK SHARMA

WITH WINDOWS 10, Microsoft wanted to combine the trustworthy features of Windows 7 with the revolutionary elements of Windows 8. What's more, users were given the chance to track the development of the OS with regular previews and then pass their feedback on to Microsoft.

There are many new features with Windows 10, but we also see the return of some old favourites, including the Start menu and Backup. Look out for tips throughout the next few pages on all of those and more. Elsewhere, Microsoft has stressed it hasn't given up on the touch interface it introduced in Windows 8. But, thanks to its commitment to the good old-fashioned keyboard and mouse, Windows 10 makes as much sense on the desktop as it does on touch-based devices.

In essence, Windows 10 looks, feels and works like a polished version of Windows 7. Microsoft has also managed to shed some of the universally panned features of Windows 8, such as the (ironically named) Charms bar, plus it's made the useful ones more customisable. The release also features new Universal Apps, which have the ability to go full screen. Overcoming the shortcomings of their earlier incarnations, these apps now function consistently, even between different devices.

While Windows 10 is easily the best version of Windows yet, there are still plenty of hints and tips we can give you to make it even better. Indeed, we've got 73 of them, so get ready to take Windows 10 to a whole new level with our essential power tips!

TAKE CHARGE OF THE START MENU

RESIZE THE START MENU

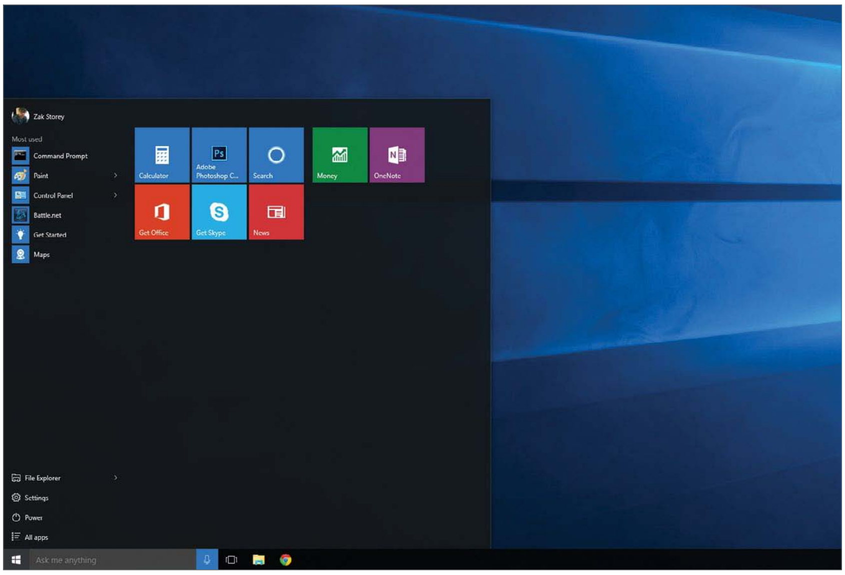
You can manually resize the Start menu as you would any other window. Just grab an edge and drag it to the new size. You can only resize it up or down, left or right. There's not the option to drag it diagonally.

ADD LIBRARIES

By default, the Start menu only displays links to the Settings app and File Explorer. To display Libraries in the Start menu, head to 'Start → Settings → Personalisation → Start' and click on the 'Customise list' link.

REARRANGE TILES

You can move tiles around the Start menu in much the same way you could in Windows 8.1. Just click, hold and drag. If they're Microsoft tiles, you can also resize them in one of the four preset sizes. If they're tiles you've pinned yourself, there are two preset sizes.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Get Office
Get Skype
News
File Explorer
Settings
Power
All apps
Ask me anything

There are stacks of customisation options to get the Start menu exactly how you want it.

HIDE YOUR RECENTLY OPENED PROGRAMS

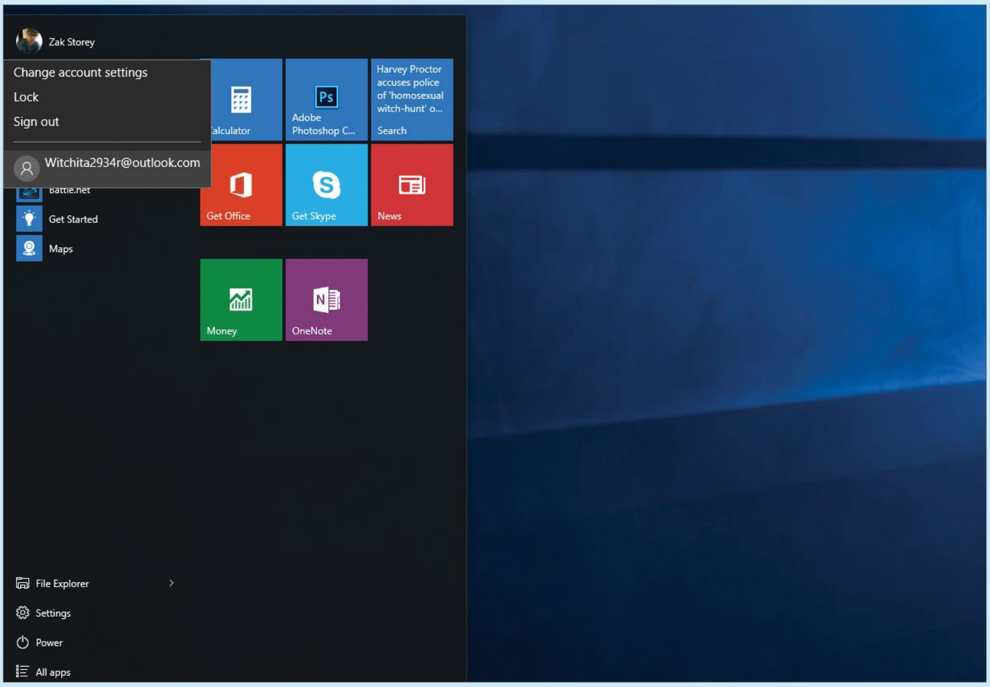
If you don't want the Start menu to show your recently opened programs and files, head to 'Settings → Personalisation → Start' and uncheck the 'Store and display recently opened programs in the Start Menu' option.

NAME TILE GROUPS

By default, the Start menu arranges all of your tiles within two groups – 'Life at a glance' and 'Play and explore'. Click on their titles to rename them. If you've pinned tiles of your own, hover over the area above them and click on the two parallel lines to name the group.

ADD YOUR APPS AND FOLDERS TO TILES

Right-click on any of your folders and select the 'Pin to Start' option to create a tile for it within the Start menu. Then follow the previous steps to rename and reposition it. You can also do the same for any app that is listed under the 'All apps' menu.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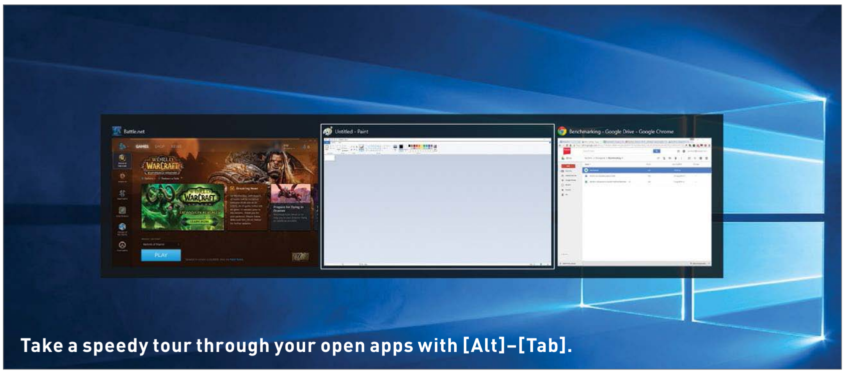
Harvey Proctor accuses police of 'homosexual witch-hunt' o...
Search
Get Office
Get Skype
News
Money
OneNote
File Explorer
Settings
Power
All apps

SIGN OUT OF WINDOWS

If you need to sign in as another user, bring up the Start menu and click your name, which is displayed right at the top. This brings up a menu that includes the option to sign out and then back in again as another user.

WINDOWS DESKTOP AND FILE EXPLORER



Take a speedy tour through your open apps with [Alt]–[Tab].

NEW APP SWITCHER

Press [Alt]–[Tab] to switch between open windows and apps. You'll see thumbnails of programs that are running – cycle through them using the [Tab] key.

MULTIPLE INTERFACES

Windows 10 automatically changes the interface based on the type of device you're using, thanks to Continuum. Furthermore, Windows 10 detects screen size and tailors the display accordingly.

PIN FOLDERS

You can manually pin folders for quick access. Just right-click on any folder, and choose 'Pin to Quick access'. To remove a folder from Quick Access, right-click and choose 'Unpin from Quick Access'.

REORDER ALL OF YOUR PINNED FOLDERS

To change the order in which folders are listed in the Quick Access view, simply select a folder and drag it above or below the other listed folders.

TURN OFF THE QUICK ACCESS VIEW

Open File Explorer, then select 'View → Options from the Ribbon'. In the 'Folder Options' window, click the 'Open File Explorer to' drop-down menu at the top and select the 'This PC' option.

PEEK INSIDE DESKTOPS

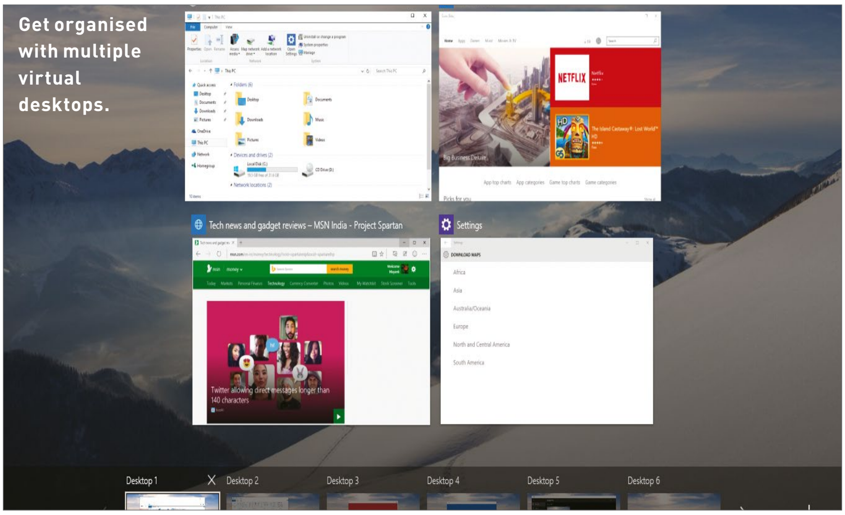
Bring up the Task View and hover over a virtual desktop to view all windows running inside it. Click on the app preview from the Task View to bring that window straight to the top.

MOVE A WINDOW TO ANOTHER DESKTOP

To move windows, bring up the Task View and drag an open window from the current desktop straight into the desktop you want to move it to. Alternatively, you can drag a window to the 'new desktop' button to create a new virtual desktop for the window. If you have a high-resolution monitor, right-click on the Taskbar and go to 'Properties'. Then use the 'Taskbar buttons' menu to select the 'Combine when Taskbar is full' option.

VIEW APPS FROM ACROSS DESKTOPS

By default, the Taskbar displays windows and apps from the current desktop. To change this, head to 'Start → Settings → System → Multi-tasking → Virtual Desktops' and select the 'All desktops' option from the drop-down menu.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Settings
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Twitter allowing direct messages longer than 140 characters
Desktop 1
Desktop 2
Desktop 3
Desktop 4
Desktop 5
Desktop 6

Get organised with multiple virtual desktops.

DECLUTTER YOUR TASKBAR

If you don't use virtual desktops or use the keyboard to switch between them, you can hide the Task View icon by right-clicking on the Taskbar and deselecting the 'Show Task View button' option.

MAKE TASKBAR OPAQUE

Go to 'Start → Settings → Personalisation → Colours' and disable 'Make Start, Taskbar and Action Center transparent' to remove the see-through effect in favour of an opaque background for the Start menu and Taskbar.

PUT THE RECYCLE BIN ON THE TASKBAR

Instead of always poking around the Explorer or minimising open windows to find the Recycle Bin icon on the Desktop, you can now simply right-click on the icon and then pin it to the Start menu as well as the Taskbar.

DISABLE NOTIFICATIONS TEMPORARILY

Avoid distraction by temporarily disabling notifications from Action Center. Just right-click the Action Center icon in the Taskbar and head to 'Hide notifications for' and choose between '1', '3' or '8 hours'.

ADD MULTIPLE DESKTOPS

You can now add multiple virtual desktops. To do this, click the 'Task View' button on the Taskbar, then click 'New desktop'. You can add as many as you like and scroll through them if they extend beyond the space on your desktop.

WINDOWS APPS AND CORTANA

PIN WEBSITES

You can use the Microsoft Edge browser to pin websites and webpages to the Start menu for quick access. Simply open the website you want to pin and click the 'More actions' button (the three dots), then select 'Pin to Start'.

READING VIEW

Edge also has a distraction-free view for reading web pages. Switch to it by clicking the 'Reading View' icon, or press [Ctrl]–[Shift]–[R]. To configure it, go to 'More options → Settings' and scroll down to the 'Reading' section.

SAVE WEB PAGES TO READ THEM LATER

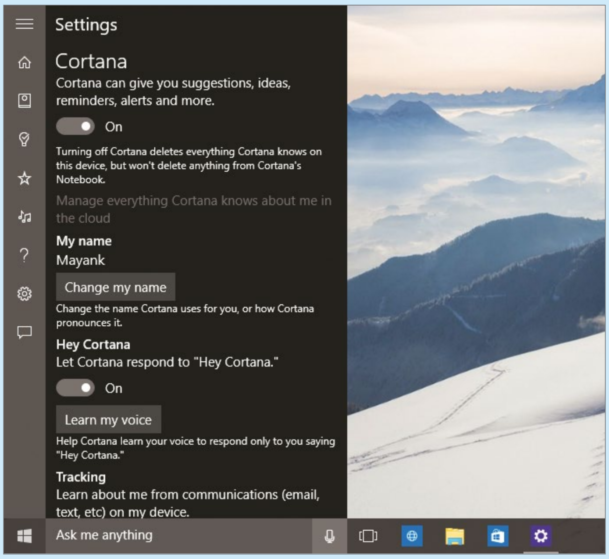
To save web pages for viewing later, click the 'Star' icon, scroll to 'Reading list' and click 'Add'. When you've found the time to read them, click the 'Hub' icon (the folder with the star) and select 'Reading list'.

CLEAR POP-UP EXCEPTIONS

To clear pop-up permissions for websites, head to 'More actions → Settings → Choose what to clear' under 'Clear browsing data'. Expand 'Show more' and tick the 'Pop-up exceptions' checkbox.

CORTANA AT YOUR SERVICE

One of the biggest additions to Windows 10 is the debut of integrated digital personal assistant, Cortana, which is built straight into the desktop and sits in the Taskbar. Cortana shows up as circles that pulse or spin when activated.



Settings

Cortana

Cortana can give you suggestions, ideas, reminders, alerts and more.

On

Turning off Cortana deletes everything Cortana knows on this device, but won't delete anything from Cortana's Notebook.

Manage everything Cortana knows about me in the cloud

My name
Mayank

Change my name

Change the name Cortana uses for you, or how Cortana pronounces it.

Hey Cortana
Let Cortana respond to "Hey Cortana."

On

Learn my voice

Help Cortana learn your voice to respond only to you saying "Hey Cortana."

Tracking
Learn about me from communications (email, text, etc) on my device.

Ask me anything

USE CORTANA

To summon up your updated digital personal assistant, Cortana, click the Search bar in the Taskbar. Or, you can use [Win]–[C] to launch its speech recognition, ask questions, set reminders and carry out other tasks.

HEY, CORTANA

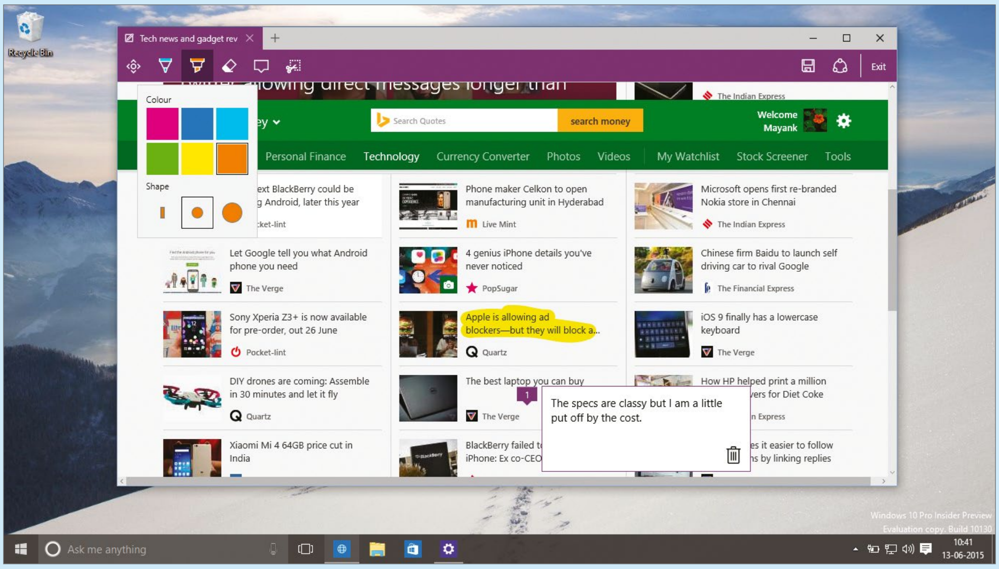
To enable voice activation for Cortana, click the search box in the Taskbar and click the menu icon in the top-left corner. Now choose 'Settings' and then enable the 'Let Cortana respond when you say "Hey Cortana"' option.

TRAIN CORTANA TO RESPOND TO YOUR VOICE

You can teach Cortana to only respond to your voice. Click the 'Search' icon and go to 'Settings' (the gear icon), then click the 'Learn my voice' button.

PLAY MUSIC ACROSS YOUR DEVICES

Upload music to OneDrive either from the website or by copying it into the OneDrive folder. Then sign into your Groove Music



Let Google tell you what Android phone you need

Sony Xperia Z3+ is now available for pre-order, out 26 June

DIY drones are coming: Assemble in 30 minutes and let it fly

Xiaomi Mi 4 64GB price cut in India

Phone maker Celkon to open manufacturing unit in Hyderabad

4 genius iPhone details you've never noticed

Apple is allowing ad blockers—but they will block a...

The best laptop you can buy

Microsoft opens first re-branded Nokia store in Chennai

Chinese firm Baidu to launch self driving car to rival Google

iOS 9 finally has a lowercase keyboard

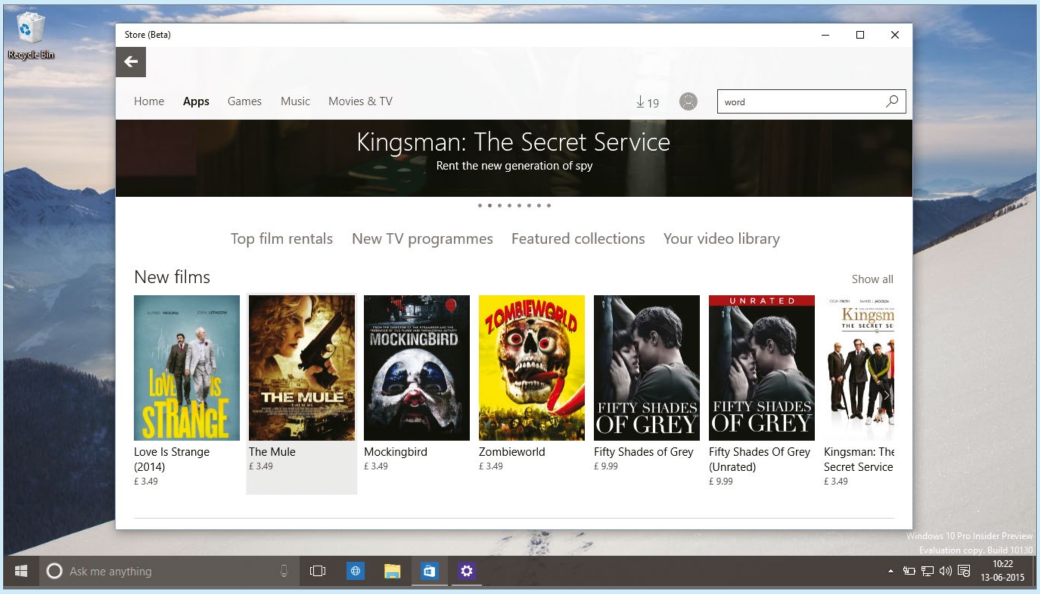
The specs are classy but I am a little put off by the cost.

DRAW DIRECTLY ON A WEB PAGE

One of the most touted features of Microsoft's new Edge browser is its ability to let you write notes, draw doodles and highlight text on any web page. The Web Note icon brings up a tool palette so you can scribble away on web pages.

BUY MUSIC AND VIDEOS

The Windows Store now has a broader range on offer and, as well as apps, it also lets you shop for games, music, movies and TV shows. You can browse and purchase music from the Music page and buy and rent videos shows from the 'Movies & TV' page.



Recycle Bin
Store (Beta)
Home
Apps
Games
Music
Movies & TV
19
word
Kingsman: The Secret Service
Rent the new generation of spy
Top film rentals
New TV programmes
Featured collections
Your video library
New films
Show all
Love Is Strange (2014) £ 3.49
The Mule £ 3.49
Mockingbird £ 3.49
Zombieworld £ 3.49
Fifty Shades of Grey £ 9.99
Fifty Shades Of Grey (Unrated) £ 9.99
Kingsman: The Secret Service £ 3.49
Windows 10 Pro Insider Preview
Evaluation copy. Build 10130
Ask me anything
10:22
13-06-2015

app, Windows Phone or another Windows PC with the same Microsoft account and the music files will automatically sync and be listed in your collection.

MANAGE PHOTOS WITH ONEDRIVE

If you have a large collection of images spread across devices, including iOS and Android, you can combine them via OneDrive, which will also remove any duplicates for you.

DISABLE THE PHOTOS APP'S AUTO-ENHANCE

The Photos app is configured to auto-enhances your pictures. If you want to leave your pictures as they are, open the app's Settings (the gear icon) and head to the 'Viewing & Editing' section. Here you can turn off the 'Automatically enhance your photos' option.

PIN EMAIL FOLDERS

Launch the Mail app and click 'More' to view all folders in your inbox. Right-click on a folder and select 'Pin to Start' to add a tile in the Start menu that takes you straight to this folder in the Mail app.

TRY THE TOUCH-FRIENDLY OFFICE APPS

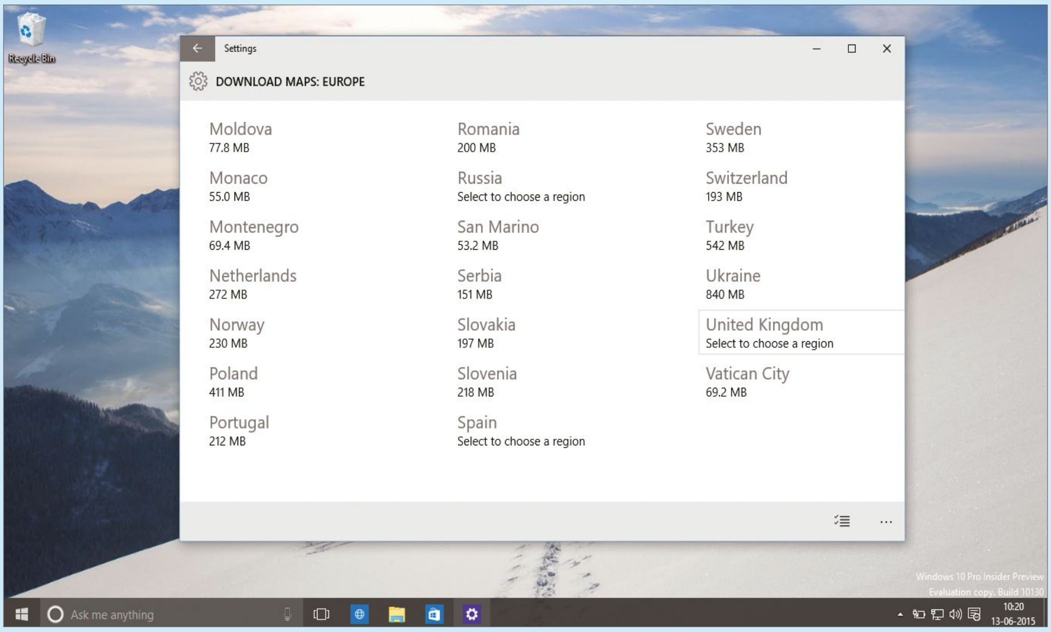
Until they're officially released later in the year, you can test the beta previews of Word, Excel and PowerPoint for free. These universal Office apps are optimised for touch and mobile use (without keyboard or mouse), and can be found in the Store.

SEAMLESSLY INTEGRATE WITH GOOGLE CALENDAR

The new Windows 10 Calendar app also has support for Google Calendar. This means you can cut down on confusion and pull in all of your existing calendar entries. Just head to 'Start → Settings → Accounts → Add account' and select Google to connect to the service.

SUPPORT FOR ANDROID AND IPHONE

A real strength of Windows 10 is its integration abilities. The Phone Companion app is designed to help users sync content between their PC and mobile phones (be it Windows Phone, Android or iOS) by helping you install all of the required components from the respective official app stores.



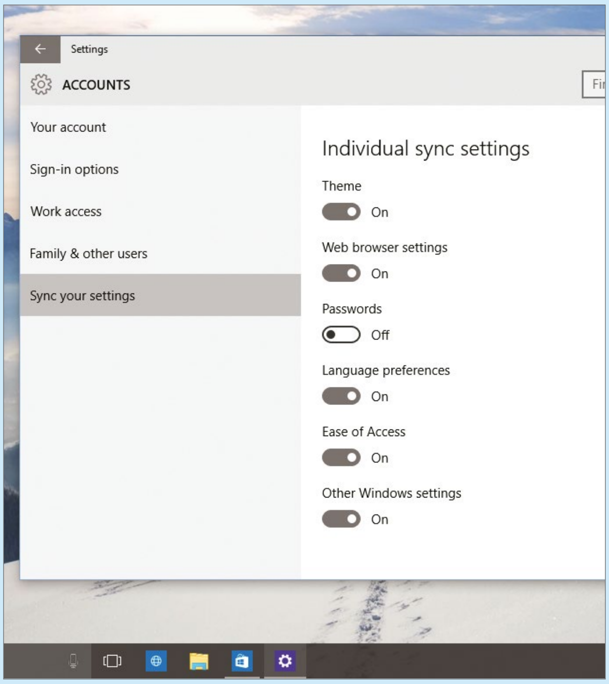
Recycle Bin
Settings
DOWNLOAD MAPS: EUROPE
Windows 10 Pro Insider Preview
Evaluation copy. Build 10130
Ask me anything
10:20
13-06-2015

Moldova	77.8 MB
Monaco	55.0 MB
Montenegro	69.4 MB
Netherlands	272 MB
Norway	230 MB
Poland	411 MB
Portugal	212 MB
Romania	200 MB
Russia	Select to choose a region
San Marino	53.2 MB
Serbia	151 MB
Slovakia	197 MB
Slovenia	218 MB
Spain	Select to choose a region
Sweden	353 MB
Switzerland	193 MB
Turkey	542 MB
Ukraine	840 MB
United Kingdom	Select to choose a region
Vatican City	69.2 MB

GET MAPS TO USE OFFLINE

The Maps app includes an offline feature. Go to 'Start → Settings → System → Offline Maps' and click the 'Download Maps' button. Now drill down to the location that you need the map for.

SETTINGS & TWEAKS



Settings

ACCOUNTS

Your account

Sign-in options

Work access

Family & other users

Sync your settings

Individual sync settings

Theme: On

Web browser settings: On

Passwords: Off

Language preferences: On

Ease of Access: On

Other Windows settings: On

CUSTOMISE SYNC SETTINGS

To take charge of the settings that synced from the current installation to your online account, head to 'Start → Settings → Accounts → Sync your settings' and disable any of the listed settings that you don't want to be synced with your Microsoft account.

BYPASS SIGN-IN

To log straight into Windows, type "netplwiz" into the Cortana search bar. This will bring up the User Accounts window. In the Users tab, deselect the 'Users must enter a username and password to use this computer' option.

SELECTIVELY SYNC FOLDERS WITH ONEDRIVE

OneDrive is now more flexible and user-friendly. To customise the folders that it syncs, right-click the icon in the notification area, select 'Settings', switch to the 'Choose folders' tab, and click the 'Choose folders' button, to select which cloud folders you want to be available locally.

ACCESS FILES REMOTELY

Under the Settings tab, if you toggle the 'Let me use OneDrive to fetch any of my files on this PC' option, then you can easily access any of the files that you've stored in the cloud from any other computer connected to the web, simply by logging into the OneDrive website (www.onedrive.com).

BRING THE APP ICONS BACK

Tablet Mode hides the app icons in the Taskbar, but you can bring them back for faster access. Right-click 'Tablet Mode' in Action Center and click 'Go To Settings'. Here disable the 'Hide app icons on the Taskbar when in Tablet Mode' option.

KNOW WHICH APPS ARE DRAINING YOUR BATTERY

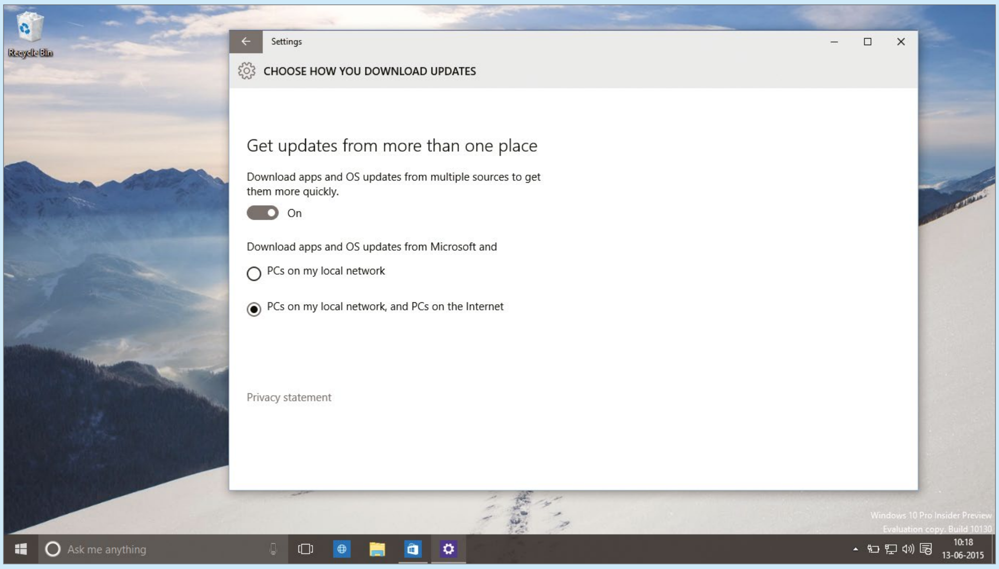
Under 'System → Battery saver → Battery use' you can check how much energy is wasted on background processes. If this number is larger than you'd like, you might want to have a detailed look at what's starting up with Windows.

EXTEND BATTERY LIFE

Limit background activity to extend battery life, especially if the previous tip reveals a large number of things going on. Go to 'Start → Settings → System → Battery saver → Battery saver settings', check the box to enable the feature, and pick a percentage at which you want it to kick in.

DISABLE TASKBAR SEARCH

If you don't use the Taskbar search that often and would rather preserve the space for something else, right-click the Taskbar, select 'Search' and select 'Show search icon' to replace the bar with a smaller magnifier icon, or 'Disabled' to remove it from the Taskbar entirely.



Settings

CHOOSE HOW YOU DOWNLOAD UPDATES

Get updates from more than one place

Download apps and OS updates from multiple sources to get them more quickly.

On

Download apps and OS updates from Microsoft and

○ PCs on my local network

● PCs on my local network, and PCs on the Internet

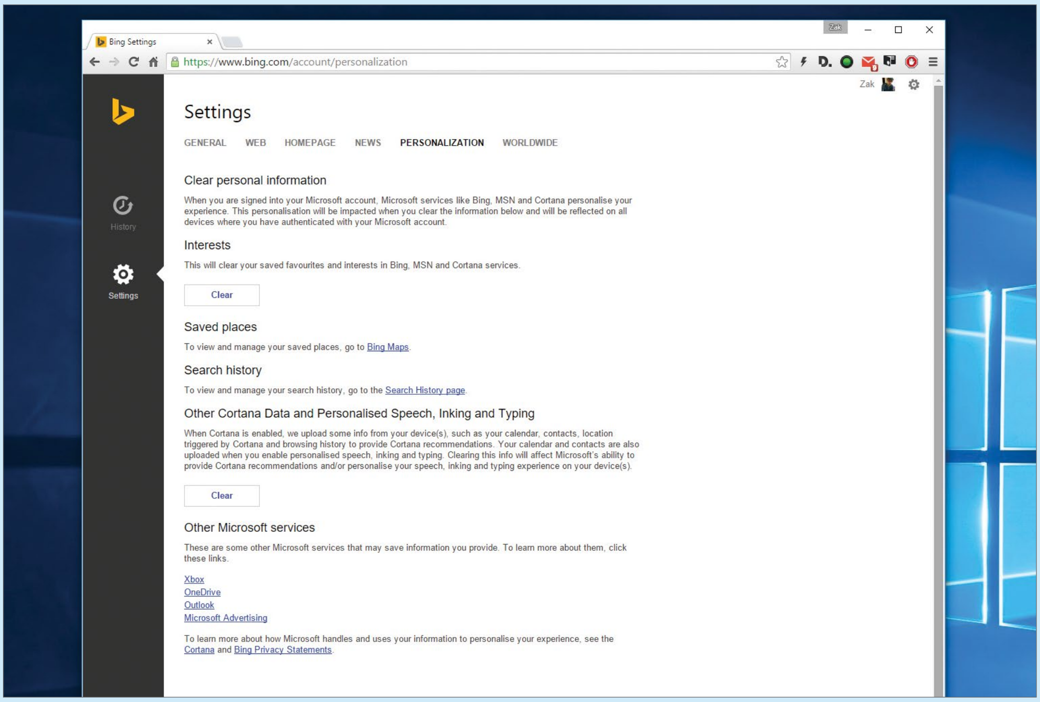
Privacy statement

PEER-TO-PEER UPDATES

Microsoft now lets you download updates using peer-to-peer technology. The option is enabled by default, but you can tinker with the setting. Head to 'Start → Settings → Update & security → Windows Update → Advanced Options → Choose how you download updates'.

BRAINWASH CORTANA

To reset Cortana, head to 'Cortana → Settings' and click the 'Manage everything Cortana knows about me in the cloud'. Click 'Clear' to wipe everything that Cortana has stored about you.



Settings

Clear personal information

When you are signed into your Microsoft account, Microsoft services like Bing, MSN and Cortana personalise your experience. This personalisation will be impacted when you clear the information below and will be reflected on all devices where you have authenticated with your Microsoft account.

Interests

This will clear your saved favourites and interests in Bing, MSN and Cortana services.

Saved places

To view and manage your saved places, go to Bing Maps.

Search history

To view and manage your search history, go to the Search History page.

Other Cortana Data and Personalised Speech, Inking and Typing

When Cortana is enabled, we upload some info from your device(s), such as your calendar, contacts, location triggered by Cortana and browsing history to provide Cortana recommendations. Your calendar and contacts are also uploaded when you enable personalised speech, inking and typing. Clearing this info will affect Microsoft's ability to provide Cortana recommendations and/or personalise your speech, inking and typing experience on your device(s).

Other Microsoft services

These are some other Microsoft services that may save information you provide. To learn more about them, click these links.

Xbox
OneDrive
Outlook
Microsoft Advertising

To learn more about how Microsoft handles and uses your information to personalise your experience, see the Cortana and Bing Privacy Statements.

CHANGE SIGN-IN OPTIONS

To switch to an alternative login mechanism, head to 'Start → Settings → Accounts → Sign-in options'. From here you can replace the password with an easier-to-remember four-digit PIN or a picture-password, if you prefer.

HELLO WINDOWS

The 'Hello' sign-in feature logs you in without a password. It cleverly uses biometric authentications, such as your face, iris or finger, to know who you are. You can set it up by heading to 'Start → Settings → Accounts → Sign-in options'.

CUSTOMISE PRIVACY

Head to 'Start → Settings → Privacy'. Here you can manage general, app-specific and hardware-specific privacy options, as well as individually define which apps can access the connected hardware.

DISPLAY A LOGIN MESSAGE

Type "secpol.msc" in the Run window and head to 'Local Policies → Security Options'. Find 'Interactive Logon: Message title for users attempting to log on', plus 'Interactive Logon: Message text for users attempting to log on'. Right-click these, hit 'Properties' and type in your message.

CHANGE NOTIFICATION CENTER ICONS

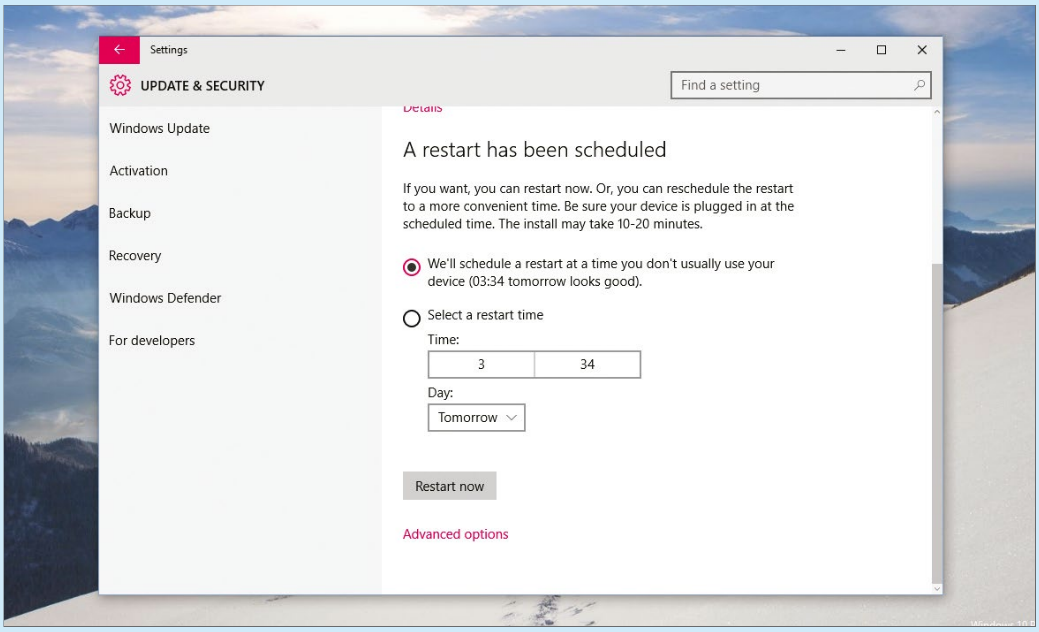
To customise the quick action icons that are displayed in the Notification Center, head over to 'Start → Settings → System → Notification & actions' and then click on the four icons displayed to select a different icon from a drop-down list.

CHANGE YOUR COMPUTER NAME

Head to 'Start → Settings → System → About' and click the 'Rename PC' button. You'll have to restart your PC to bring this change into effect.

SCHEDULE RESTARTS

To restart the PC to install updates at chosen times, head to 'Start → Settings → Updates and Security → Windows Update → Advanced Options'. Under the 'Choose how updates are installed' pull-down menu, select the 'Notify to schedule restart' option.



A restart has been scheduled

If you want, you can restart now. Or, you can reschedule the restart to a more convenient time. Be sure your device is plugged in at the scheduled time. The install may take 10-20 minutes.

● We'll schedule a restart at a time you don't usually use your device (03:34 tomorrow looks good).

○ Select a restart time

Time: 3 34

Day: Tomorrow

ADVANCED TRICKS

IMPROVED COMMAND PROMPT

The oft-ignored PowerShell also gets a slew of new features to make it more user-friendly. It now supports word wrap and you can resize it, which also increases its buffer size. It also has much-improved keyboard controls for editing and selection.

ACCESS 'GODMODE'

A long-time favourite of the power user, 'GodMode' unveils a Power User menu that brings together all your system's far-flung settings and configuration options into one single location. Just create a new folder and rename it 'GodMode.{ED7BA470-8E54-465E-825C-99712043E01C}'.

GET RID OF OLD STUFF

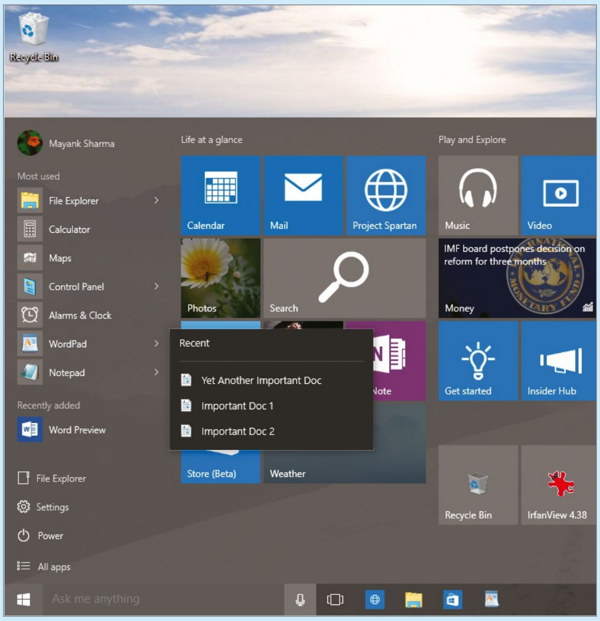
If you've no intention of reverting to the previous version of Windows, save disk space by getting rid of the old OS files. Head to 'Control Panel → System and Security → Administrative Tools → Disk Clean-up' and tick 'Previous Windows installations'.

CUSTOMISE THE DISK SPACE FOR PROTECTION

To customise the disk space for protection, first launch the Control Panel and head to 'System and Security → System → System protection'. Now click 'Configure' (under 'Protection Settings') and use the slider next to 'Max Usage' as you need to.

SPEED UP APP LAUNCHES AT BOOT

On a fast machine, you can disable the app startup delay. Launch regedit and then navigate to 'HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Explorer'. Right-click Explorer, select 'New → Key', and name it 'Serialize'. Under this key, create a DWORD value called 'StartupDelayInMSec' and set it to '0'.


Recycle Bin
Mayank Sharma
Most used
File Explorer
Calculator
Maps
Control Panel
Alarms & Clock
WordPad
Notepad
Recently added
Word Preview
File Explorer
Settings
Power
All apps
Life at a glance
Calendar
Mail
Project Spartan
Photos
Search
Recent
Yet Another Important Doc
Important Doc 1
Important Doc 2
Store (Beta)
Weather
Play and Explore
Music
Video
IMF board postpones decision on reform for three months
Money
Get started
Insider Hub
Recycle Bin
IrfanView 4.38
Ask me anything

JUMP LISTS IN START MENU

Save time by using Jump Lists with your most-used apps. In Registry Editor, head to 'HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Explorer\Advanced' and create a new DWORD named 'EnableXamlJumpView' and set its value to '1'. Then restart your PC.

REGISTRY EDITOR!

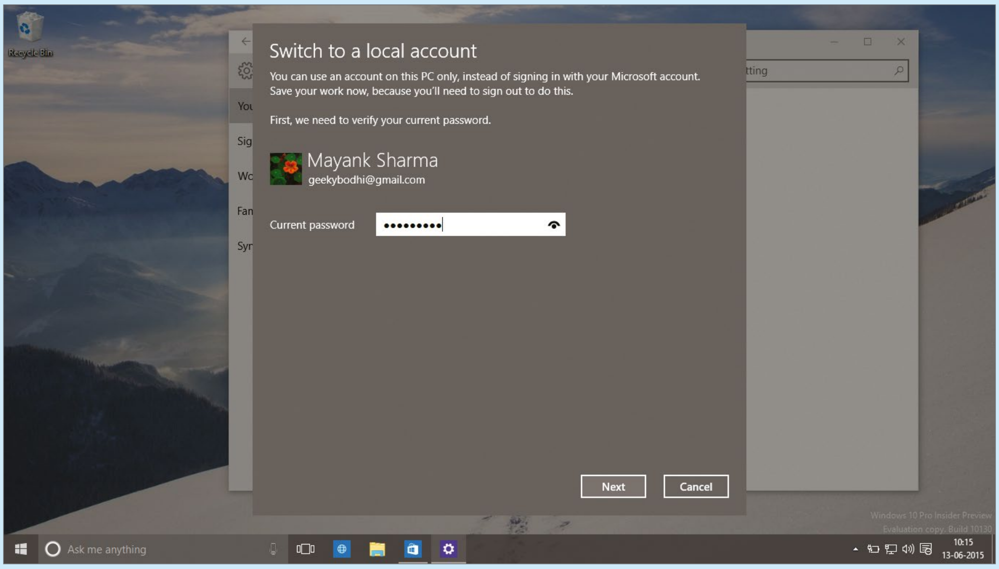
Power users rejoice! Microsoft has finally decided to spend some time improving the Registry Editor. It now lets you jump between the same entries under the 'HKEY_LOCAL_MACHINE' and 'HKEY_CURRENT_USER' hives using a special context-menu entry.

MOUNT ISO IMAGES

You don't need any third-party software to browse the contents of an ISO image. Right-click it and hit 'Mount'. The ISO images are mounted as virtual discs and you can access them from the File Explorer.

RESTART EXPLORER

To quickly apply changes that require restarting the computer, launch the Task Manager by right-clicking on the Taskbar. Click the 'More Details' button and under the 'Processes' tab look for an entry named 'Windows Explorer'. Then right-click it and select 'Restart'.


Switch to a local account

You can use an account on this PC only, instead of signing in with your Microsoft account. Save your work now, because you'll need to sign out to do this.

First, we need to verify your current password.

Mayank Sharma
geekybodhi@gmail.com

Current password ••••••••••

Recycle Bin
Next
Cancel
Ask me anything
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Evaluation copy. Build 10130
10:15
13-06-2015

CREATE A LOCAL ACCOUNT

If you don't want the benefits of a OneDrive synced account, you can create a standalone offline account. Head to 'Start → Settings → Accounts' and click the 'Sign in with a local account instead' link.

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ADVANCED TRICKS

CREATE A RECOVERY DISC

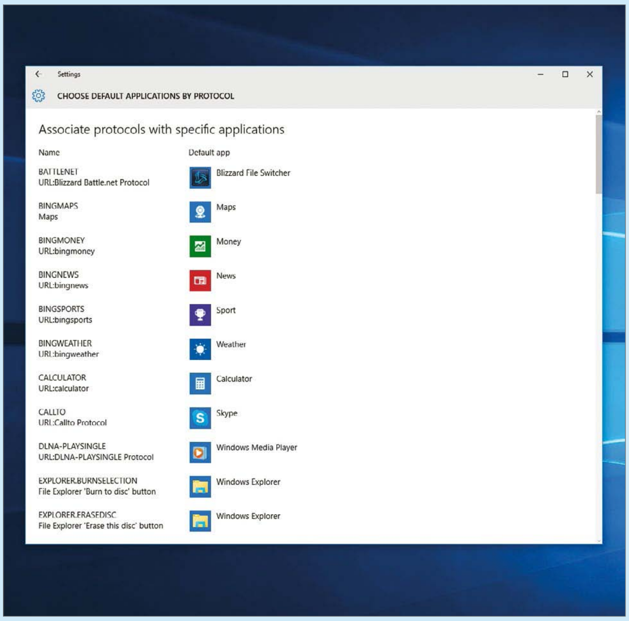
Plug in a USB drive and head to 'Start → Settings' and type "recovery" in the 'Find a setting' textbox and select the 'Create a recovery drive' option. This will launch a wizard that wipes the USB drive and transforms it into a recovery drive.

CREATE A SYSTEM IMAGE

Head to 'Start → Settings', type "file" in the textbox and select the 'File History' tool. Then click the 'System Image Backup' link so you can select the destination drive for storing the backup image.

CUSTOMISE THE POWER USER MENU

To reorganise or remove entries in the Power User menu, go to 'C:\Users\<username>\AppData\Local\Microsoft\Windows\WinX'. Here you'll notice three folders that house entries for the Power User menu. You can move any of them around or remove them as per your requirements.



Associate protocols with specific applications

Name	Default app
BATTLENET URL:Blizzard Battle.net Protocol	Blizzard File Switcher
BINGMAPS Maps	Maps
BINGMONEY URL:bingmoney	Money
BINGNEWS URL:bingnews	News
BINGSPORTS URL:bingsports	Sport
BINGWEATHER URL:bingweather	Weather
CALCULATOR URL:calculator	Calculator
CALLTO URL:Callto Protocol	Skype
DLNA-PLAYSINGLE URL:DLNA-PLAYSINGLE Protocol	Windows Media Player
EXPLORER.BURNSELECTION File Explorer 'Burn to disc' button	Windows Explorer
EXPLORER.ERASEDISC File Explorer 'Erase this disc' button	Windows Explorer

CHOOSE DEFAULT APPS BY PROTOCOL

To define default apps based on their protocols, head to 'Start → Settings → System → Default apps'. Scroll down to the bottom and click the 'Choose default applications by protocol' option.

ENABLE THE HANDY ADMINISTRATOR ACCOUNT

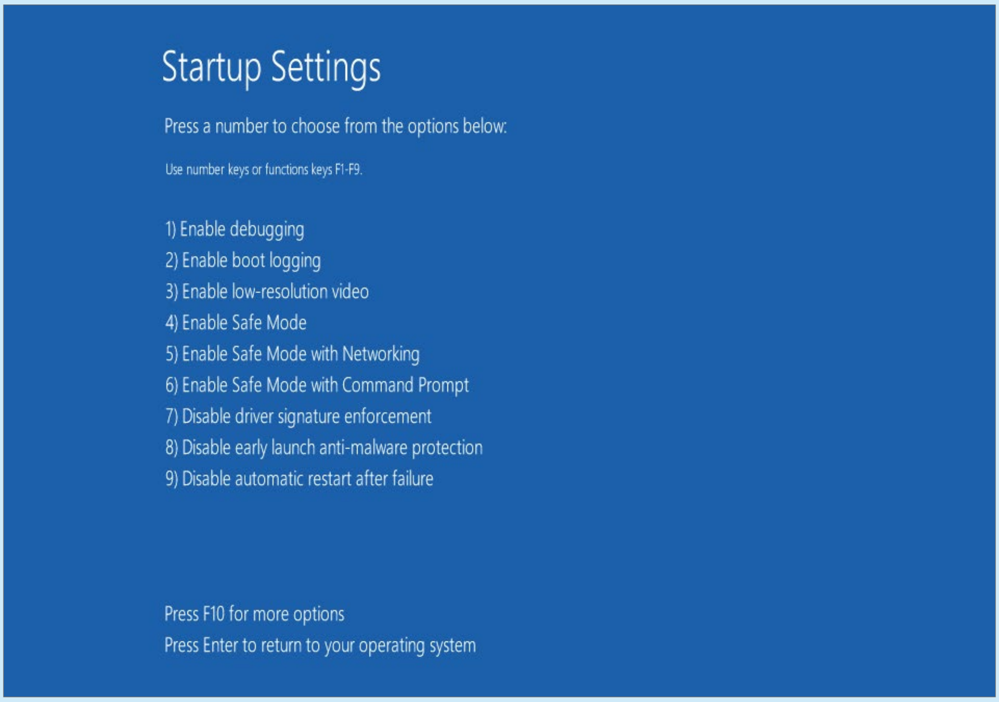
By default, the built-in Administrator account is hidden. To enable it, launch the Command Prompt as Administrator and type "net user administrator /active:yes". Now, logout to see the newly added Administrator account on the login screen.

CUSTOMISE AUTOMATIC MAINTENANCE

Launch the Control Panel and head to 'System and Security → Action Center'. Then expand the Maintenance section and click on the 'Change maintenance settings' link and use the dropdown menu to select a convenient time.

CREATE A 'CLEAR CLIPBOARD' SHORTCUT

To quickly clear your clipboard of all the regular build-up of unwanted stuff, you can easily create a handy shortcut. Just right-click (or press and hold) on an empty area on your desktop, and click/tap on 'New' and then 'Shortcut'. ■



Startup Settings

Press a number to choose from the options below:

Use number keys or functions keys F1-F9.

1) Enable debugging
2) Enable boot logging
3) Enable low-resolution video
4) Enable Safe Mode
5) Enable Safe Mode with Networking
6) Enable Safe Mode with Command Prompt
7) Disable driver signature enforcement
8) Disable early launch anti-malware protection
9) Disable automatic restart after failure

Press F10 for more options
Press Enter to return to your operating system

START YOUR PC IN SAFE MODE

Hold [Shift] down and click 'Restart'. In the Advanced Startup screen, go to 'Troubleshoot → Advanced options → Startup Settings' and click 'Restart'. When your computer restarts, you'll see a list of options that includes Safe Mode.

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Intel i7 Elite (HAS11)
INTEL Core i5 4790K (O.C 4.6Ghz*)
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HARDWARE

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Don't cry my friends, this is only the beginning!

> "After more than 300 issues over nearly a quarter of a century, *PC Format* has run its course. Sad times."

YOU KNOW, I've only been working here at *PC Format* for a grand total of three months, but my oh my, how these days have passed. It's been an interesting learning curve. A steep one, too. Taking apart PCs and their components has always been a hobby of mine, but once you get into this kind of industry and have access to all manner of hardware, the nature of the beast changes. You become almost disconnected from the extremity of some of the products you hold. Over the last year, we've seen both Nvidia and AMD release some incredible pieces of graphical hardware; Intel launch Skylake and announce 3D Xpoint; and Samsung blow everyone away with phenomenally large SSDs.

Alas, however. After more than 300 issues over nearly a quarter of a century, *PC Format* has run its course. If you haven't heard by now, this will be the last issue to ever grace the shelves of your local newsstand. Sad times. It's a magazine that literally started life the same month that I was born. More recently, however, it's fallen out of favour with the financial plans of our publishing overlords. Understandable, if not a little saddening. Which leads me to my next item.

Benchmarking procedure. Now, I know what you're thinking. What the hell? Why even bother talking to us at this point? I understand, you're upset. But trust me, reworking the benchmarking procedure is just as vital at this point in time as any other.

With the release of Skylake, I decided the way we test and produce our graphics cards benchmarks needed a serious overhaul. The way I'd originally intended to do it was to overclock the cards to their absolute limits, tone it back by 50MHz and then benchmark and test from there, utilising the same settings (where possible). For the games that didn't contain in-game benchmarking procedures, we'd record the frame rates, take values from five specific time stamps in each benchmark, and add and divide to provide the average. Obviously, this has its limitations, the big one being that it simply doesn't provide us with enough information. We don't learn how these cards perform at a full overclock or at stock (where the vast majority of users use their cards anyway). So what's the big shake up?

Well, the new plan, other than revamping the test bed (to an i7-6700K and 16GB of DDR4), is to take two sets of benchmarks. One at stock and one overclocked, at three separate resolutions: 1080p, 1440p and 4K. Then, on top of this, we'd pull all of the frame values into Excel, find the average using every frame, as opposed to five per run, and on top of that, we'd take power readings and temperature readings. This would provide us with a far better look at how the card or GPU performs overall. We also took another look at our games suite. Let's face it, no one plays *Crysis 3* for 12 hours a day, five days a week.

But ultimately, why does any of this matter? Well, two reasons really. As a team, we also help produce the American sister title of *PC Format*, called *Maximum PC*. Not only does it have a bigger digital footprint than *PC Format*, but it also has access to some weird and wonderful hardware that isn't so easy to get

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GTX 980Ti
NVIDIA

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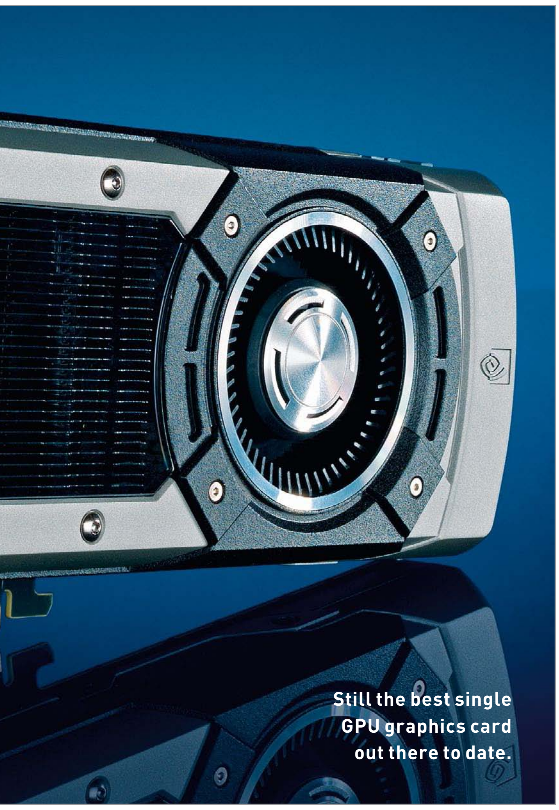
Nvidia is taking names and kicking ass.

a hold of in the UK. That means more varied and accessible reviews for you here in good ol' Blighty. So, if you're still looking for the same level of detailed reviews and occasional witty banter (granted, our cousins across the pond still don't understand cynical British humour, but hey, we're gonna keep trying), then head over to www.maximumpc.com and subscribe to *Maximum PC*. Additionally, we'll hopefully be taking a lot of these reviews over to *PC Gamer*, another of our sister titles, where all of these benchmarking procedures will come in particularly handy.

It's been a pleasure writing and researching for you all, and for those of you who can't tag along for the ride, all of us here would just like to wish you the very best. Thanks for keeping us going for the last 24 years and for putting bread in the mouths of all of our talented writers, designers and editors. So long, and thanks for all the fish. **–ZAK STOREY**



Still the best single GPU graphics card out there to date.

Editor's One to Watch

Nvidia's latest mobile GPU

THE SPECS FOR NVIDIA'S latest mobile graphics processor have been leaked. According to ComputerBase.de, which managed to get a hold of one of Asus's new ROG GX700 laptops, the GTX 990M will be based off of a fully unlocked Maxwell GM 204 chip.

That means we can expect to see the full compliment of 2,048 stream processors, 128 texture units, 64 raster operation pipelines and a 256-bit memory interface. The core clock comes in at roughly 1,190MHz, meaning that, for spec, you're looking to be getting performance comparable to a fully fledged desktop discrete graphics GTX 980.

Of course, this is a graphics processor that will only be seen in the highest of high-end gaming laptops. But it's still an incredibly exciting prospect, especially considering the GM 200 was just too hot and too power hungry to run fully unlocked in any laptop.

There's been no mention of a memory buffer. However, for comparative performance, Nvidia's current top-of-the-line GTX 980M has a total of 500 less stream processors than the 990M. That's the equivalent of dropping down from a desktop 980 to a 970.

Inevitably, this will bump up the price of these laptops quite considerably. And with Asus just announcing its first iteration of water-cooled docking laptops, who knows how far this will extend. According to ComputerBase, these GPUs in particular will be cooled inside of Asus's new fully water-cooled docking station, allowing for the processor to operate 80 per cent faster than the base version.

The GX700 also comes with a 4K screen and up to 64GB of RAM. Prices are rumoured to be somewhere around the region of £3,500. So, you know, it will definitely be a very subtle, totally not in your face, definitely middle-of-the-road sort of laptop.

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Asus GeForce GTX 950 STRIX OC

All the grunt you need for everyday 1080p gaming

LET'S FACE FACTS. No matter what kind of gamer you are, you can guarantee that 99 per cent of the time, you won't be buried in the latest AAA title from [enter evil megalomaniac game publisher name here]. After all, the latest games from Ubisoft and EA, while featuring incredible levels of graphical fidelity, often have as much depth as any of Michael Bay's recent Hollywood blockbusters.

The majority of games we play aren't system-destroying behemoths. And while titles such as *The Witcher 3* or *Shadow of Mordor* look to be bucking that trend in comparison to the usual FPS money-grab spewed out by EA or Activision every year, they too will eventually retire, destined to sit in your Steam library for the rest of time.

The STRIX is as striking as ever... if you like owls.

Dota 2, *World of Warcraft*, *Minecraft*, *Rome 2*… These are just some of the most popular games on the planet today. Not because they create a rip between the realms of digital polygons and reality, but because they're accessible, because you can't complete them in six hours. And this is the reason the GTX 750 and its Ti variants sell like hotcakes.

OUTPACING THE GTX 680

It's also why, continually, these lower-end cards are actually the money-makers and, coincidentally, provide the best bang for the buck out there. This leads us quite nicely to the latest Nvidia GPU launch. The GTX 950, a graphics processor that's not only built from the new Maxwell architecture (making Nvidia's current lineup rebrand-free), but also quite the impressive little frame-renderer to boot. And what better way to get stuck into this review than inside of Asus's STRIX Gaming card.

The GTX 950 comes in with a hefty 768 CUDA cores, around half that of a GTX 680, and the same amount of memory as well. Now, we know what you're thinking: "Why on Earth are you bringing up a three-year-old top-tier graphics card? The short answer is because this card can outperform it. Yep, you heard right.

Maxwell enables the GTX 950 to be overclocked to hell and back. If you've managed to put on your big boy pants today, you'll find that given just a little shunt up to the maximum stable overclock, you can get performance that in some synthetic benchmarks actually outstrips that of the GTX 680. How that translates to games we'll come to shortly, but this is one hell of a feat by any card.

But what if you don't want to deal with any of that nonsense? (And rightly so!) Well, Asus has you covered. At stock, the Asus STRIX GTX 950 OC is clocked around 120MHz higher than the reference cards, providing you with a comfortable 7–11 per cent improvement in game. The card also features Asus's automated manufacturing process, ensuring top-quality reliability across the range, and a noise-optimised dual-fan heatsink situated on top of the GPU, ensuring the card stays cool and quiet even while under load.

PRICE COMPARISON

Unfortunately, you don't make it away entirely scot-free. Due to how low the pricing is on these cards (in comparison to Nvidia's other offerings), you do lose out on the rather stylish backplate found on the 960 STRIX edition.

For the price, it's not exactly a super-budget graphics card, either. It's currently available from www.overclockers.co.uk for an almost reasonable £150. Yet, if you were to just drop an additional £20, you could grab yourself a cleaner-looking, cooler, higher-performing Asus STRIX GTX 960.

All in all, this makes us wonder whether the 950, as a GPU, is actually worth investing in. Even on the low end, the cheapest you can grab any one of these new graphics processors is £130. That's something that really gives us pause for thought, especially considering you still need one 6-pin power to run it, unlike its 750 brother.

Enough chit-chat, we'll let the benchmarks do the talking. All in all, if you're looking for a solid performing 1080p graphics card, the STRIX has you covered for all your gaming needs.
–ZAK STOREY

VERDICT
8

Asus GeForce GTX 950 STRIX OC

+ CHEAP AND CHEERFUL
Silent; small; aesthetically pleasing; fully automated PCB process; great bang for your buck.

− REDUCED SECTION Lose out on a backplate; £20 more will get you a 960.

£150, www.overclockers.co.uk

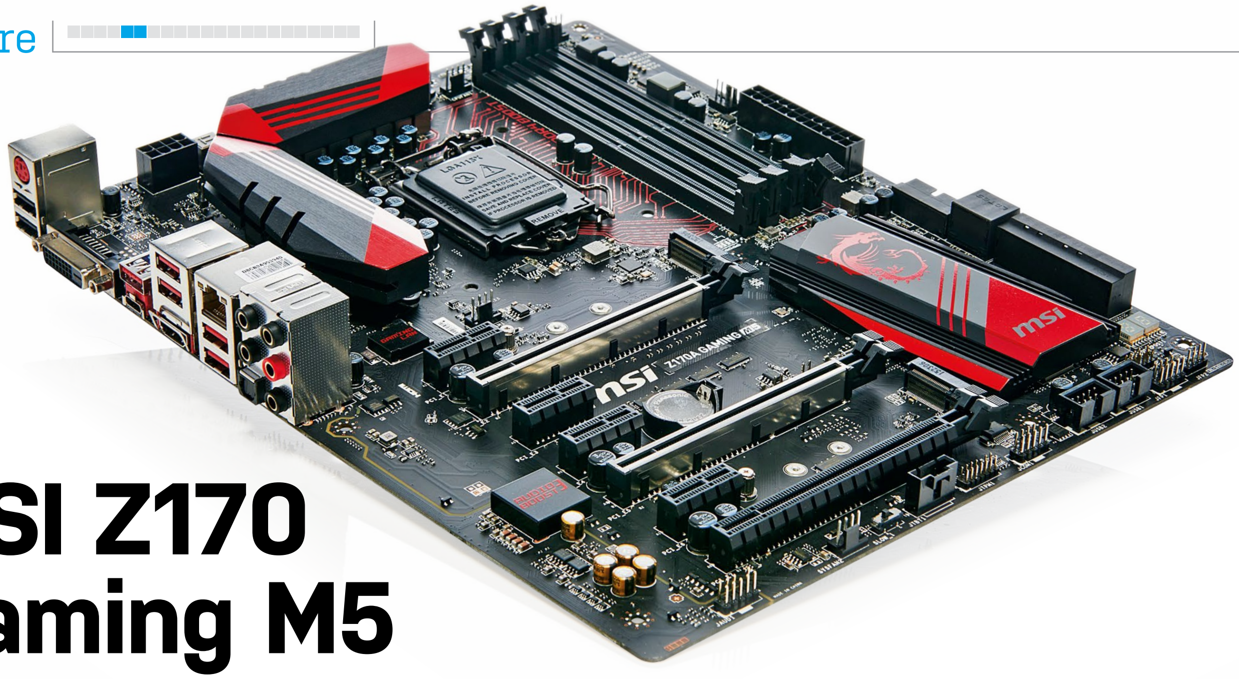
SPECIFICATIONS

GPU	GM 200 Maxwell
CUDA cores	768
ROPs	32
Memory capacity	2,048B
TDP	90W
Power requirement	1x 6-pin
Connectivity	3x DisplayPort, 1x HDMI, 1x DVI-I

BENCHMARKS

	Asus STRIX GeForce GTX 950 Gaming 2GB	Asus STRIX GeForce GTX 960 Gaming 2GB
Dota 2	141 / 179	**159 / 189**
World of Warcraft	**113** / 159	111 / **176**
Total War: Attila	18 / 23	**21 / 27**
Metro: Last Light	21 / 30	**24 / 35**
Project Cars	22 / 24	**24 / 27**
Witcher 3: The Wild Hunt	23 / 28	**29 / 34**
Shadow of Mordor	27 / 37	**28 / 40**
Star Citizen: Hangar Walk	14 / 38	**34 / 44**
3D Mark: FireStrike	6,085	**6,808**
Power draw (peak)	**185W**	221W
Power draw (idle)	**47W**	48W

Best scores are bolded. Game results are minimum/average fps at 1080p.



MSI Z170 Gaming M5

A modest punt on gaming grunt?

LAST ISSUE, we had our first taste of Intel's new Skylake CPU architecture. As a pure processor, it didn't exactly wow our whelm. While you ponder if that even makes sense, know this. It was the platform that underpins Skylake, namely mobos with the Z170 chipset, that actually flabbered our ghast, and in a good way.

Anyway, we had a look at two cheap Asus boards, around £120, and an MSI effort nearer £180. None quite hit the spot. The Asus boards felt a bit borky, while the MSI seemed a little too much of a stretch. What we wanted was something in between. Something higher-quality than entry level, but without being plastered in expensive gimmicks and gizmos.

On paper, at least, what we want looks a lot like this new MSI 170 Gaming M5. It's from the same premium line as last month's MSI Z170 Gaming M7, but it's £30 cheaper. The question is, what do you lose in the transition and does any of it matter?

Some of the critical things you don't lose start with a nice, premium feel. The board has a nice matte finish and the heatsinks are reassuringly hefty. Pretty much all of the features we really care about have survived, too. So, there are two M.2 ports for super-fast SSDs, though just like on the M7, only one will work at full reheat in PCI Express mode. It's got the full gambit of USB connectivity, too. And gambit isn't an overstatement, what with no less than four different types of USB socket on the back panel. Specifically, that's USB 2.0, 3.0, 3.1 and 3.1 Type-C. Phew.

There's also support for AMD Crossfire and Nvidia SLI multi-GPU graphics, a lovely full-feature UEFI BIOS interface and even an LED debug display on the motherboard. As for what's missing, well, there's no DisplayPort connectivity for the integrated graphics output, which we can't say bothers us, and you don't get on-boards buttons for power and reset.

THE SKYLAKE KICKBACK

Which just leaves the absence of MSI's rotary Game Boost dial. The idea here is to enable idiot-proof overclocking. Just twizzle the dial to your preferred setting, reboot and let the board handle the rest. Except you don't get it with the M5. Ah.

But hang on. Our experience with Game Boost wasn't pure, unalloyed joy. We found results can be patchy from one boot to the next, and it's also a little sensitive to memory spec. At best, it matches what you can achieve with hand tuning, so even if it was more consistent, it's dubious value if that's all you're getting for the extra £30.

Except it isn't. At stock clocks, the cheaper M5's performance looks dandy. Not that this is a huge surprise. So much functionality now resides on the CPU die itself that motherboards have increasingly become rather dumb receptacles.

However, with Skylake, there's been a little kickback in the opposite direction, with Intel relocating the CPU voltage regulator back onto the motherboard. Given that achieving really high overclocks is dependent at least in part on delivering a clean, consistent power supply to the CPU, you might expect a bit more overclocking variance between Z170 motherboards than its progenitor, the Z97, tended to allow.

If the M5 is anything to go by, that's probably correct. By falling short of the M7 at 4.6GHz maximum versus 4.7GHz with our Intel Core i7-6700K chip, the M5 is slightly but definitely off the pace. Whether that extra 100MHz is worth £30 is up to you. –JEREMY LAIRD

VERDICT 8

MSI Z170 Gaming M5

+ GAME ON Great feature set; bags of storage and USB bandwidth; good build quality.

− GAME OVER Overclocking performance very slightly off the pace; doubts over dual M.2 connectivity.

£149, www.msi.com

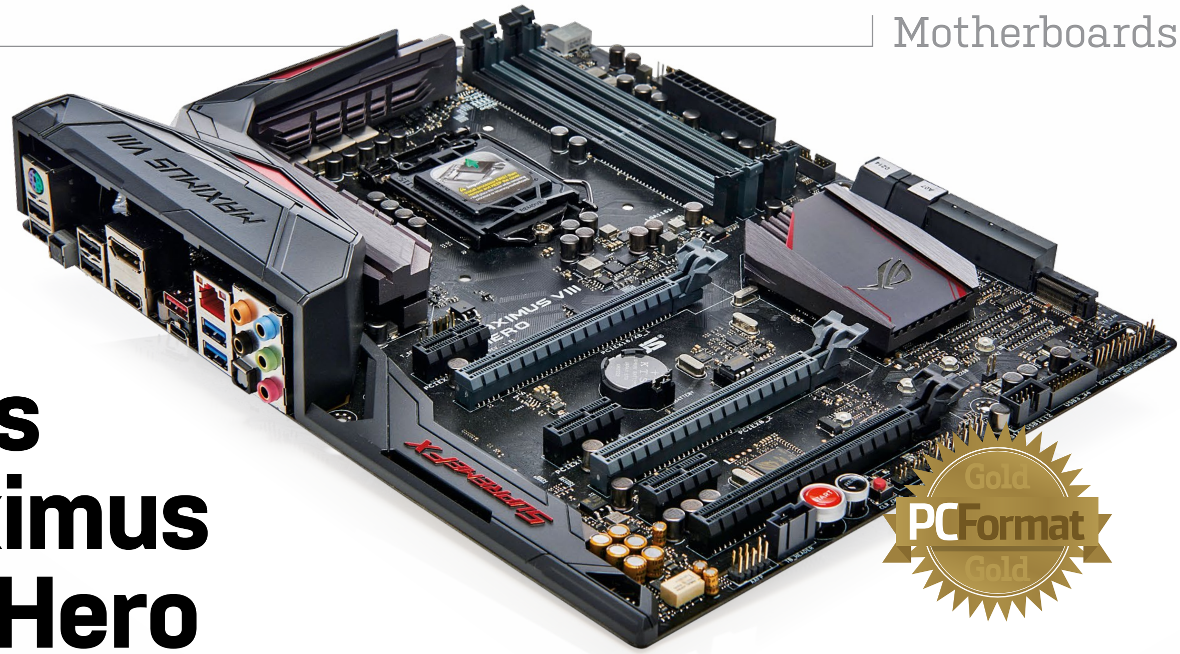
BENCHMARKS

	MSI Z170 Gaming M5	MSI Z170 Gaming M7	Asus Z170 Pro Gaming	Asus Z170-A
Cinebench R15 (index)	**915**	**915**	883	914
x264 video eoncoding (fps)	56	**58**	55	57
Memory bandwidth (GB/s)	**26**	**26**	**26**	**26**
Shadow of Mordor (min/avg fps)	61 / 93	62 / 91	57 / 92	**63 / 92**
Maximum overclock (GHz)	**4.8**	**4.8**	**4.8**	**4.8**

Best scores are bolded. All tests with Intel Core i7-6700K.

SPECIFICATIONS

Chipset	Intel Z170
Socket	LGA1151
Form factor	ATX
Storage	2x SATAe, 2x M.2, 4x SATA
USB	4x USB 2.0, 2x USB 3.0, 1x USB 3.1, 1x USB 3.1 Type-C
Multi-GPU	Crossfire, SLI



Asus Maximus VIII Hero

So pretty, so stylish, so not very red...

ASUS, REPUBLIC OF GAMERS. It's a coveted name. A brand that's shifted from premium products to a more encompassing mobo and graphical solutions line, and now appears to be a convergence of the two. The colour red has always followed RoG, so it's also interesting to note that Asus has moved from its usual design style, in favour of something a little more subtle.

The Maximus VIII Hero turns up somewhere in the middle of Asus's eighth iteration of Maximus motherboards, with the first Hero being introduced way back with Haswell and the Z87 chipset. The launch of the first Hero marked RoG's entry to the mainstream, a move that pulled most of its high-end expertise into the more consumer-grade marketplace. The Hero became the quintessential mobo of choice, a board ideal for any PC gamer worth their salt, one looking to build a clean, decent-looking rig. So, has this changed? Yes, yes it has.

As far as feature sets go, you get the traditional selection of high-end on-board audio components alongside Asus's Sonic Studio II; you get high throughput via Intel's gigabit networking solution; and you get all of the perks found in AI Suite III for cooling and overclocking. What's more intriguing, however, is the inclusion of a new and improved RAM cache technology.

Traditionally, RAM disk software hasn't massively helped PC gamers gain any edge or speed over their non-RAM disk-using rivals. This is mostly down to how the software operates, usually only allowing temporary internet cache files or scratch disk files to be created, stored and deleted (as after all, RAM is volatile memory). In Asus's iteration, however, you simply select which games and files you'd like to utilise the RAM cache. As soon as you log in, the RAM cache will efficiently cache the most mission-critical files. What this does is decrease loading and transfer speed times by almost half, even on traditional SSDs, for files large or small.

HEY, GOOD LOOKIN'

What matters here is the look of the board. And, by God, it's stunning. With a full rear I/O cover extending all the way down, covering the majority of the audio componentry; solid black MOFsets; and every PCIe, DRAM and SATA port being either grey or black, it's hard not to choose the Asus if you're looking for a sleek black build. If it wasn't for the lack of armour, this board could be comparable to the Maximus VII Formula, a mobo we're still eagerly awaiting. And in today's age, it wouldn't be complete without some RGB lighting, huh? Well, Asus has you covered.

Ultimately, the Hero is utterly straightforward. It performs solidly, it looks incredible and is from a family of motherboards renowned for its high-end products. Going forwards, this will be a board we use as our dedicated test rig for all of our future graphics cards and CPU comparisons. And why not? It's gorgeous and fantastically well-rounded, with enough connectivity to keep us happy for at least the next year (which is a long time in the tech world).

In conclusion, if you're looking for a great all-rounder that's packed with features and is better-looking than Cheryl Cole, this could be the one for you. If we had to complain about anything, other than the lack of any extreme differentials in performance, it would be the inclusion of RGB LEDs on a board that's littered with flecks of red detailing. Otherwise, it performs admirably. **–ZAK STOREY**

VERDICT
9

Asus Maximus VIII Hero

+ HERO Best-looking board we've seen; RAM cache is brilliant; good connectivity; stunning UEFI; dedicated water-pump header.

− ZERO The RGB LEDs don't make sense with the red decoration.

£170, overclockers.co.uk

BENCHMARKS

	Asus Maximus VIII Hero	MSI Z170 Gaming M7
Cinebench R15 (index)	911	**915**
x264 video eoncoding (fps)	57	**58**
Memory bandwidth (GB/s)	**29**	26
Shadow of Mordor (min/avg fps)	61 / **93**	**62** / 91
Maximum overclock (GHz)	**4.8**	**4.8**

Best scores are bolded. All tests with Intel Core i7-6700K.

SPECIFICATIONS

Chipset	Intel Z170
Socket	LGA1151
Form factor	ATX
Storage	6x SATA, 1x M.2, 2x SATA Express
USB	4x USB 2.0, 2x USB 3.0, 1x USB 3.1 Type-A, 1x USB 3.1 Type-C
Multi-GPU	Crossfire, SLI

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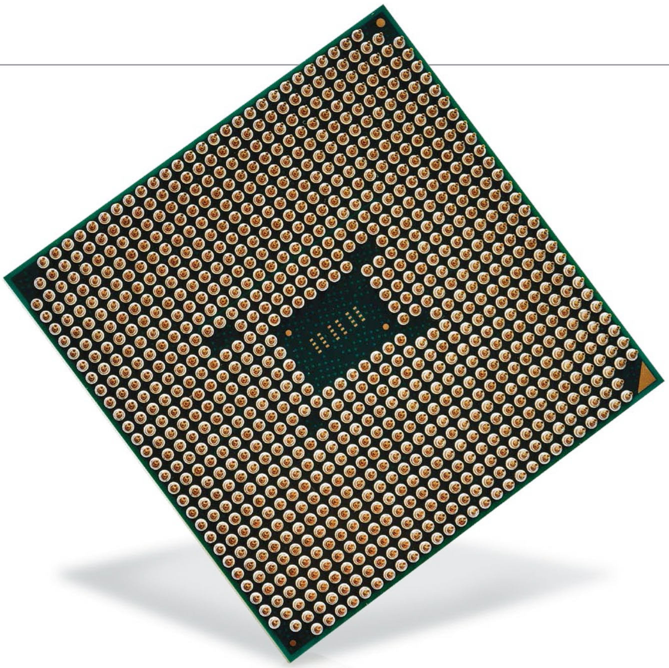

AMD A8-7670K

Nothing more than a reviewer's hell

LET US TELL YOU about the experience we had reviewing AMD's A8-7670K APU. It came in a tiny little white box. Presumably not the retail packaging. God, let's hope not. Though judging by AMD's lack of marketing share, this could be the real deal. It's not possible to tell whether the 7670K went to another reviewer before us. Anyway, after setting up our standard test platform, we installed the chipset and began our preliminary testing.

Overall, the processor has a total of two computational cores, providing four threads. Say what you like about compute cores, AMD, but Prime95 and Cinebench don't lie to us, and this processor is quite the slow processor. Unfortunately, with 60 per cent of the CPU taken up by the graphical side of things, the overall performance in these applications is still quite limited. That explains why, even though the 7670K clocks an average of 3.6GHz at max, we achieved some pretty mediocre benchmarks when it came to computational tasks. In fact, we left it to complete our 30GB archive test, but after taking 30 minutes to complete 49 per cent, we figured it would be a better use of our time to stop the process and continue with our other benchmarks instead.

So began the task of installing the Nvidia GeForce GTX 980 (which we use on all of our standardised reviews) alongside AMD's latest offering. We throw the card in. It boots, freezes, then black screens. And won't pick up the display under any other circumstance. Why are we bringing this up? Well, this is all part of the user experience. You'll hear people mention how you're meant to drop as much money as you can into the GPU and not the CPU. But perhaps you decided to take an entry-level Nvidia GPU with your cheap-as-chips AMD processor. In which case, you may very well face these same problems we're facing here. It's unfortunate, but we push on, now only being able to complete a moderate portion of our benchmarks.

TIME TO RETIRE

The biggest problem here is the fact this is still a processor based off an almost five-year-old architecture. It's only 28nm. It has limited SATA 6GB/s support. And continues to only support DDR3 up to 2,133MHz, even though it's the one platform that would benefit the most from those increased memory speeds.

The list goes on. Intel may only be upping performance by 10 per cent every year or so, but the most vital thing it's including is chipset updates. This forces manufacturers to update their mobos, and in turn provide extra expansion, storage options and more modern features. Hell, it's worth it if only for the design reboots a lot of these boards get.

In gaming, the situation isn't much better. Yes, you can run titles like *Dota 2* at acceptable frame rates at 1080p (if 20-30fps is acceptable to you), but unless you're only playing simple games and MOBAs, you're not going to get much joy from it. For comparison, in *Shadow of Mordor* it achieved an average frame rate of just 4fps at 1080p. A GTX 950 managed an average of 33.

We understand this is an £82 processor and you shouldn't be expecting a great deal at this price point. But for compatibility, ease of use and performance, you'd do so much better to head elsewhere. That's the sad truth, and it's worrying for the future of AMD. Godavari, so far, lacks any substance. It's aimed at one demographic – people that will most likely game on laptops anyway – with most desktop users opting for dedicated GPUs. It's too limited, too expensive and too basic to provide anything to any form of power user. Please AMD, we need Zen. And we need it soon.
–ZAK STOREY

VERDICT 6

AMD A8-7670K APU

+ GOD-LIKE Great for simple browsing or using Microsoft Office; motherboards are cheap; low power consumption; very low entry point gaming.

– DOG-LIKE Targeted at laptop users; relatively expensive; lacks new chipset and support for DDR3.

£82, www.ebuyer.com

BENCHMARKS

	AMD A8-7670K	Intel Core i7-4790K
Cinebench R15 (index)	294	**877**
PCMark (index)	2,592	**4,388**
x264 (avg fps)	33	**90**
ATTO SSD write / read (MB/s)	496 / 526	**530 / 553**
AS SSD 4K write / read (MB/s)	33 / 63	**40 / 112**
FireStrike (index)	617	**848**
Idle power draw (W)	92	**90**
Ramped power draw (W)	**282**	350
Idle temperature (°C)	41	**32**
Load temperature (°C)	**65**	72

Best scores are bolded.

SPECIFICATIONS

Cores/threads	10 Cores (4 CPU + 6 GPU)
Process tech	28nm
Clockspeed	3.9GHz / 3.6GHz
Architecture	Godavari
Socket	FM2+
L2 Cache	4MB
TDP	95W
Memory	2,133MHz DDR3
Graphics	Radeon R7

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OCZ Trion 100

Getting a little TLC from Toshiba

IN THIS BRAVE NEW WORLD of PCI Express storage, of M.2 drives, U.2 drives and fancy NVMe protocols, is there any space for ye olde 2.5-inch SATA drives and their piffling 6Gb/s of bandwidth and crusty AHCI interfaces?

That this is even in doubt says a lot about how fast storage technology for the PC has changed in recent years. An SSD hooked up via four lanes of PCI Express connectivity has the potential to be as much as five times faster than a SATA drive, in terms of raw throughput. What's more, that NVMe protocol promises much better random access performance.

On the other hand, even a mediocre SATA SSD will annihilate a conventional magnetic hard drive by pretty much any metric. But here's the real kicker. Unless your PC is super new, odds are it won't support M.2, SATA Express or any of that PCI Express newness. Of course, adaptor cards are available. But compatibility can be hit and miss. In other words, if you're looking for a painless option for upgrading your storage, SATA drives will remain relevant for some time to come.

Enter, therefore, OCZ's latest, the Trion 100. Tested here in 960GB spec, it's a big old beast for a solid-state drive in terms of capacity, but such is the plummeting price of flash memory these days, it can be had for under £250. In other words, we're fast approaching the time when you can have both speed and capacity in a vaguely affordable SSD.

How does OCZ do it? Well, regular readers will recall that Japanese megacorp Toshiba snapped up OCZ whole when the latter got into financial difficulties. This drive is therefore a baby of OCZ's marriage with Toshiba.

REAL-WORLD WORRIES

No surprise, then, that is uses Toshiba NAND memory. And not just any old NAND memory, but Toshiba's latest TLC, or triple-level cell memory. More data bits per cell means more data density and lower cost per gigabyte, of course. It also sports a Toshiba TC58 controller chipset, details on which are basically non-existent. But the take home here is that this drive's OCZ-ness probably doesn't extend much further than branding. OCZ is now Toshiba's brand for retail SSD.

So, how does it perform? Patchily, if the truth be told. The headline raw bandwidth numbers in the ATTO benchmark look pretty spiffing. Like most SATA SSDs these days, it's basically bumping into the limitations of the storage interface. But as soon as you step outside of that best-case box, things can get a bit wonky.

In AS SSD's incompressible sequential tests, for instance, the results for the write test, in particular, were all over the place. We ran it around 15 times and the spread of results was over 200MB/s, with the top-scoring 436MB/s still not being that great and feeling like a one-off. Also up and down were 4K random writes.

Oddly, the Trion's performance in the PCMark consistency test was less volatile, albeit from a not hugely impressive baseline. But if we had to pick a killer blow, it would be the Trion's tardy performance in our 30GB file copy test. At nearly four and half minutes, it's getting on for twice a slow as Samsung's 850 Pro 2TB model. Yes, that's a much more expensive drive. But it provides uncomfortable context for the Trion's real-world performance. **–JEREMY LAIRD**

VERDICT 6

OCZ Trion 100

⊞ **GOOD LOVIN'** Punchy pricing for such a big drive; reassuring 240TB endurance rating.

⊟ **NEEDS SOME TLC** Very patchy performance in some benchmarks, both synthetic and real-world; three-year warranty is a little on the stingy side.

£249, www.ocz.com

BENCHMARKS

	OCZ Trion 960GB	Samsung 850 Pro 2TB
AS SSD incompressible sequential read (GB/s)	**513**	**513**
AS SSD incompressible sequential write (GB/s)	436	**499**
AS SSD 4K random read (GB/s)	31	**41**
AS SSD 4K random write (GB/s)	92	**126**
ATTO sequential read (GB/s)	**564**	404
ATTO sequential write (GB/s)	**517**	427
5GB zip compression (secs)	**194**	**194**
30GB file copy (secs)	263	**160**

Best scores are bolded. Tested on Intel Z170 motherboard with Intel Core i7-6700K CPU.

SPECIFICATIONS

Interface	SATA 6Gb/s
Form factor	2.5-inch
Capacity	960GB
Controller	Toshiba TC58
Memory type	19nm TLC NAND
Max IOPS	90,000
Endurance	240TB
Warranty	Three years

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SUPPORTS intel CORE inside

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SUPPORTS intel CORE inside

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- MSI Z170A PC MATE Motherboard
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- Fast 16GB DDR4 2400MHz Memory
- 2TB Hard Drive
- 240GB Patriot Blaze SSD
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Corsair Strafe Mechanical Keyboard

Clicky quality for less than £100... just

MECHANICAL KEYBOARDS. Love them or hate them, they're here to stay. Whether you're still not convinced it's worth dropping the extra £60 or £70 on a fuzzy mechanical key switch or not, it might be worth giving this review a read.

Corsair has brought to the table a slimline version of its popular Vengeance series of boards. It's a brand synonymous with solid build quality and premium feature sets, and the Strafe doesn't disappoint. Packing Cherry MX Red key switches, it's quiet, but still has that mechanical sound and feel associated with Cherry's carefully crafted clackers.

If this is your first time delving into the world of Cherry switches, you'll find the Red switch is very soft to the touch. It has an incredibly sensitive actuation point, meaning that placing just a small micron of pressure down on the key will activate the switch, without any tactile feedback to let you know that you've activated the key. Sounds bad? Well, not entirely. Once you adjust to the new switch style, you'll find it's actually very responsive, meaning it's much easier to react to otherwise more difficult situations. It's ideal for gaming.

The overall build quality of the Strafe is impressive. Although it has a plastic outer shell, the keyboard itself has very little flex. This is primarily down to Corsair including an aluminium support bar through the middle of the board itself, not that you'll ever see it. And while it lacks the classy metal chassis of its older K70 Vengeance brothers, the Strafe is still a good-looking keyboard with a beautiful set of outlying LED stripes to complement the overall gaming feel. It also features the LED controller found in Corsair's latest RGB series of peripherals. That means you can have any number of complex LED wave patterns and responses to boot. It sounds like a gimmick, but trust us, you can spend hours just staring at your keyboard as it rotates around like a Cylon or ripples from your touch.

BEYOND THE CYLONS

Other features include media control via the function keys, brightness control and a Windows lock key. The board also comes with a USB passthrough, which is handy. Depending on whether or not you're playing MOBAs, you can even change out the key caps and the more traditional WASD keys.

The only downside to this board is the lack of truly dedicated media keys. It would've been nice to have seen a dedicated volume wheel and other keys in the top-right. However, for the price point, it's understandable why Corsair couldn't include them. Other than that, a wrist rest would have been a bonus, too, as it can sit a little high on your desk. Again, this does take some time to get used to.

Granted, there are a few alternative mechanical keyboards out there for this price, but none of them feature the same integrated LED controller or the modern level of gaming aesthetic design as seen on the Strafe. That said, you can pick up a K70 Vengeance in red now for the same price – despite its slightly dated design, the dedicated media keys and all-aluminium body is incredibly tempting (not to mention the lack of garish sails). Should you buy this? Well, if you like pretty lights and want a solid, dependable and versatile gaming keyboard, then yes, the Strafe is certainly worth considering. It could be your weapon of choice. –ZAK STOREY

VERDICT
8

Corsair Strafe Mechanical Keyboard

+ DOG FIGHTER Build quality; good-looking design; LED controller; authentic Cherry switches; USB passthrough.

– CANNON FODDER Lack of dedicated media keys; still £100; lack of aluminium chassis; no wrist rest; difficult key caps.

£99, www.overclockers.co.uk

SPECIFICATIONS

Switch	Cherry MX Red / Brown
Connectivity	USB passthrough
Size	448 x 170 x 40mm (full keyboard layout)
LEDs	Individually lit (red)
Report rate	Selectable 8ms, 4ms, 2ms, 1ms and BIOS
Macro keys	All of them
Matrix	100% anti-ghosting, 104 key rollover

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Razer Firefly

Let there be cables

WHERE ON EARTH should we start with this? Let's go with a little bit of a history into mousemats. That's what we usually do, right? Mousemats have existed for as long as there have been trackball mice.

So, not for very long. And ever since optical sensors came into life in the mid noughties, they almost became null and void. In fact, it's entirely possible to run a PC, and game quite effectively, without using one at all (as long as it's not a glass surface). It's likely that you'll find people out there who are still using some bent and broken Harry Potter mousemats from over 10 years ago.

However, that's not why we're here. And if you're anything like us, you want to optimise every part of your gaming experience. So, what advancements have there been for us PC enthusiasts? Well, first came the multi-surfaced mousemats, designed to allow the user a variety (usually two) of different feels depending on how fast the user wanted their mouse to track. Then, beyond that, came the introduction of hard mats. Initially constructed from aluminium, these mousemats provided crisp, smooth traction and a solid feel that made it easy to clean. However, they were known to flake and damage over time.

Eventually, R&D labs across the mousemat community came to a solid and plastic textured finish. These provided greater durability and often included the ability to interchange between two sides, depending on what texture you preferred.

So, what is it that Razer has done to advance on this prestigious line of multi-textured gaming-surface research and development? LEDs! And not only LEDs, but 16.8 million colours-worth of LEDs. And what does this inevitably mean? A cable! And a rather annoying bump at the front of the mousemat.

WHAT'S THE POINT?

We'll admit that, from a distance or from the side, this mousemat does look quite good… but if you're in a well-lit room and are sat actually using it, the only LED you'll notice is the Razer logo in the top-right-hand corner of the device. Can we call it a device? Ultimately, it's a little bit of a disappointment. The range of effects are impressive, if only you could see them. Unless you're admiring your mousemat from a distance, or playing in absolute darkness, something which is not conducive for your eyesight, it's going to have a minimal impact on how much your epeen holds up.

But the biggest problem by far is the cable hub at the top. If you've ever used a mat for any prolonged period of time, you'll notice you only really use around 20–30 per cent of the total surface area. This is most apparent on mousemats that wear away over time. And because of that one reason, we managed to hit the wired hub at least once every 10-15 minutes. That doesn't sound like much, but it's the most frustrating thing, not being able to glide elegantly across the screen due to this small raised barrier jarring your movement and blocking your path down the rock-strewn valley to gaming victory.

We just can't recommend dropping £55 on a mousemat with a few LEDs. It adds another cable to your desk, its tracking surface isn't interchangeable and the LEDs are something you'll forget or not see unless you're not on your PC. You're entirely better off getting a cheaper, LED-free alternative and buying a crate of beer with the change. **–ZAK STOREY**

VERDICT **3**

Razer Firefly

➕ **BROWN COATS** It's a mousemat; moderately okay LED controller; interesting concept.

➖ **THE ALLIANCE** Wired hub is a nightmare; can't see LEDs well; another cable; price; one less USB port; doesn't make sense.

£55, www.box.co.uk

SPECIFICATIONS

Dimensions	355 x 255 x 4mm
LEDs	16.8 million colours
Textures	One

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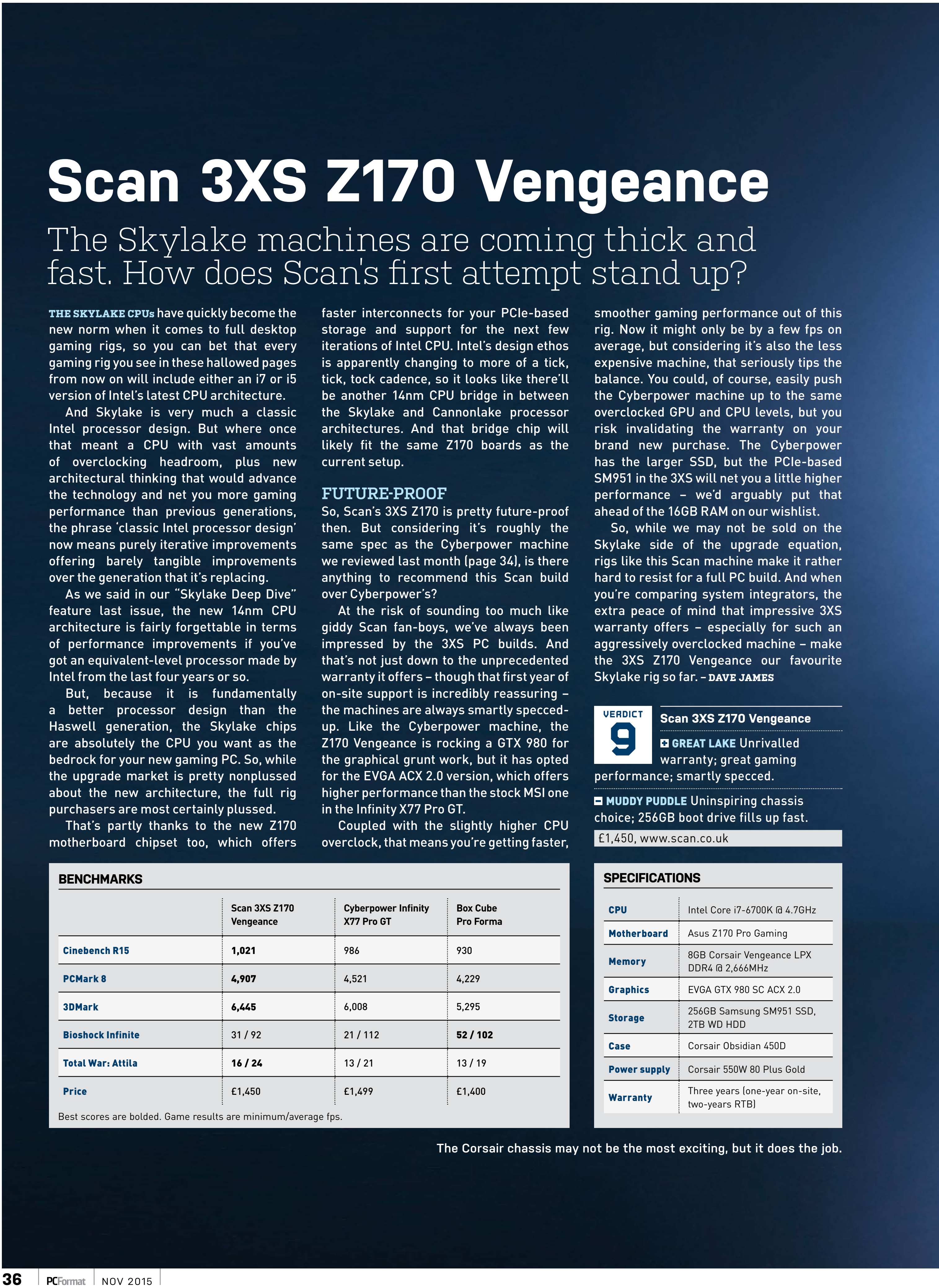


Scan 3XS Z170 Vengeance

The Skylake machines are coming thick and fast. How does Scan's first attempt stand up?

THE SKYLAKE CPUs have quickly become the new norm when it comes to full desktop gaming rigs, so you can bet that every gaming rig you see in these hallowed pages from now on will include either an i7 or i5 version of Intel's latest CPU architecture.

And Skylake is very much a classic Intel processor design. But where once that meant a CPU with vast amounts of overclocking headroom, plus new architectural thinking that would advance the technology and net you more gaming performance than previous generations, the phrase 'classic Intel processor design' now means purely iterative improvements offering barely tangible improvements over the generation that it's replacing.

As we said in our "Skylake Deep Dive" feature last issue, the new 14nm CPU architecture is fairly forgettable in terms of performance improvements if you've got an equivalent-level processor made by Intel from the last four years or so.

But, because it is fundamentally a better processor design than the Haswell generation, the Skylake chips are absolutely the CPU you want as the bedrock for your new gaming PC. So, while the upgrade market is pretty nonplussed about the new architecture, the full rig purchasers are most certainly plussed.

That's partly thanks to the new Z170 motherboard chipset too, which offers faster interconnects for your PCIe-based storage and support for the next few iterations of Intel CPU. Intel's design ethos is apparently changing to more of a tick, tick, tock cadence, so it looks like there'll be another 14nm CPU bridge in between the Skylake and Cannonlake processor architectures. And that bridge chip will likely fit the same Z170 boards as the current setup.

FUTURE-PROOF

So, Scan's 3XS Z170 is pretty future-proof then. But considering it's roughly the same spec as the Cyberpower machine we reviewed last month (page 34), is there anything to recommend this Scan build over Cyberpower's?

At the risk of sounding too much like giddy Scan fan-boys, we've always been impressed by the 3XS PC builds. And that's not just down to the unprecedented warranty it offers – though that first year of on-site support is incredibly reassuring – the machines are always smartly specced-up. Like the Cyberpower machine, the Z170 Vengeance is rocking a GTX 980 for the graphical grunt work, but it has opted for the EVGA ACX 2.0 version, which offers higher performance than the stock MSI one in the Infinity X77 Pro GT.

Coupled with the slightly higher CPU overclock, that means you're getting faster, smoother gaming performance out of this rig. Now it might only be by a few fps on average, but considering it's also the less expensive machine, that seriously tips the balance. You could, of course, easily push the Cyberpower machine up to the same overclocked GPU and CPU levels, but you risk invalidating the warranty on your brand new purchase. The Cyberpower has the larger SSD, but the PCIe-based SM951 in the 3XS will net you a little higher performance – we'd arguably put that ahead of the 16GB RAM on our wishlist.

So, while we may not be sold on the Skylake side of the upgrade equation, rigs like this Scan machine make it rather hard to resist for a full PC build. And when you're comparing system integrators, the extra peace of mind that impressive 3XS warranty offers – especially for such an aggressively overclocked machine – make the 3XS Z170 Vengeance our favourite Skylake rig so far. – **DAVE JAMES**

VERDICT
9

Scan 3XS Z170 Vengeance

+ GREAT LAKE Unrivalled warranty; great gaming performance; smartly specced.

− MUDDY PUDDLE Uninspiring chassis choice; 256GB boot drive fills up fast.

£1,450, www.scan.co.uk

BENCHMARKS

	Scan 3XS Z170 Vengeance	Cyberpower Infinity X77 Pro GT	Box Cube Pro Forma
Cinebench R15	**1,021**	986	930
PCMark 8	**4,907**	4,521	4,229
3DMark	**6,445**	6,008	5,295
Bioshock Infinite	31 / 92	21 / 112	**52 / 102**
Total War: Attila	**16 / 24**	13 / 21	13 / 19
Price	£1,450	£1,499	£1,400

Best scores are bolded. Game results are minimum/average fps.

SPECIFICATIONS

CPU	Intel Core i7-6700K @ 4.7GHz
Motherboard	Asus Z170 Pro Gaming
Memory	8GB Corsair Vengeance LPX DDR4 @ 2,666MHz
Graphics	EVGA GTX 980 SC ACX 2.0
Storage	256GB Samsung SM951 SSD, 2TB WD HDD
Case	Corsair Obsidian 450D
Power supply	Corsair 550W 80 Plus Gold
Warranty	Three years (one-year on-site, two-years RTB)

The Corsair chassis may not be the most exciting, but it does the job.

SCAN 3XS SYSTEMS
CORSAIR

Alienware 15 with Graphics Amplifier

Sure, it's a nice solution. But what was the problem?

GAMING AND LAPTOPS have never been best mates. This is a simple fact. The problem is that the confines of a laptop chassis aren't well-suited to a hot, angry graphics chip. They consume so much power. They produce hideous amounts of heat.

So, the traditional choice has been between gaming laptops that were good at portability but not actually that great for gaming, and barn-sized lappies that had decent gaming chops but had to be trailered from one location to another. Almost. You just can't have it both ways.

Or can you? What if you could take the gaming grunt *out* of the laptop's chassis, to allow the laptop to be properly portable but still have gaming goodness? Now you can with the Alienware 15. Actually, this isn't the first time we've seen a gaming laptop with an external box for graphics. MSI's GS30 offers precisely the same trick.

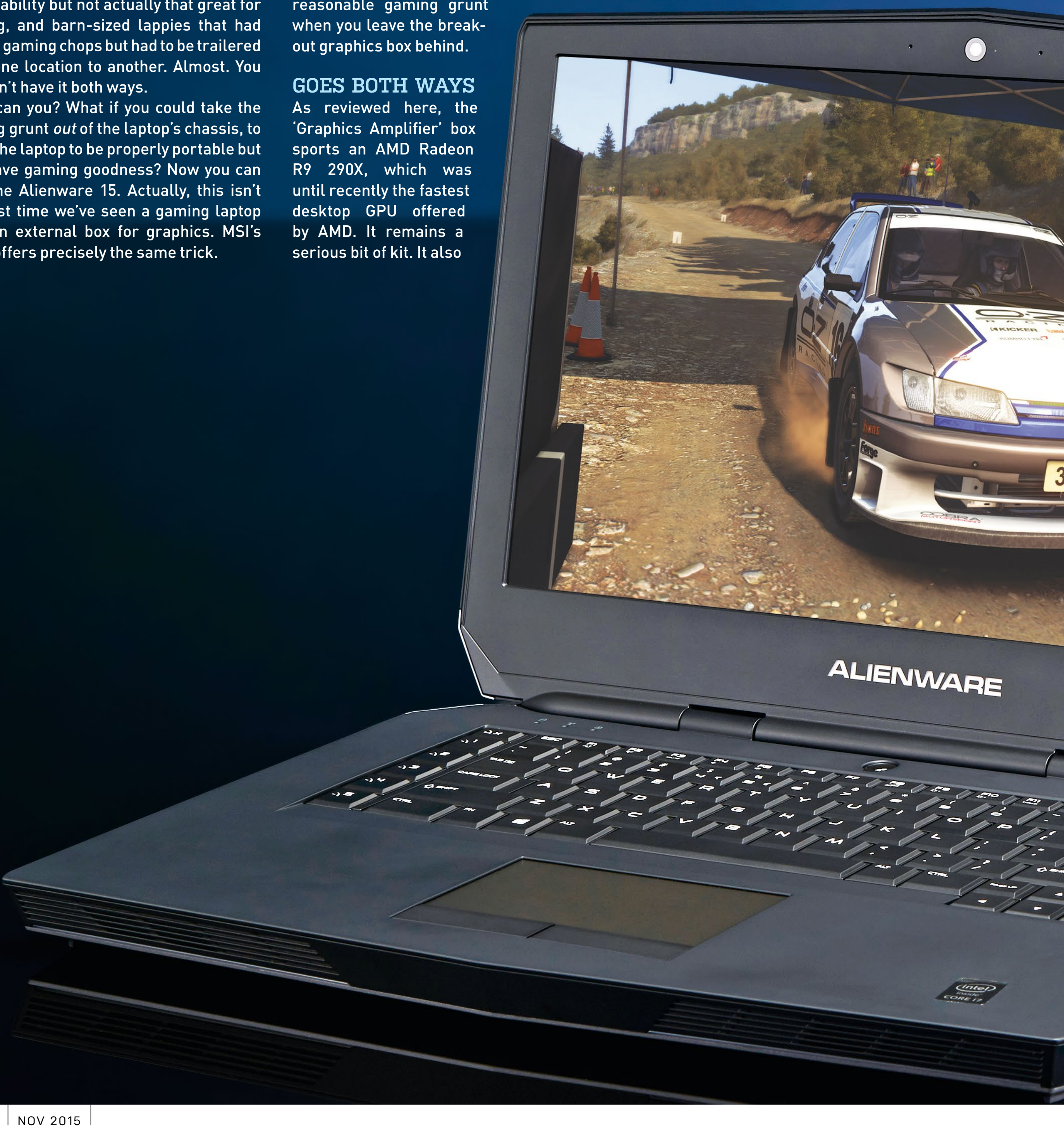
Both depend upon a proprietary connection to the external box using PCI Express signalling. But there are differences. For starters, the Alienware 15 sports surprisingly capable graphics in its laptop chassis. There's a mobile Nvidia GeForce GTX 970M GPU. That's important because it means you retain reasonable gaming grunt when you leave the break-out graphics box behind.

GOES BOTH WAYS

As reviewed here, the 'Graphics Amplifier' box sports an AMD Radeon R9 290X, which was until recently the fastest desktop GPU offered by AMD. It remains a serious bit of kit. It also brings us to our first glitch. This laptop is running both Nvidia and AMD graphics with drivers for both installed in parallel. Okay, we didn't have any problems during testing. But it makes us uncomfortable about long-term stability.

Still, we're also happy to report that with the break-out box hooked up, the video output works just fine on both external displays and the 15's own 15-inch panel. The only obvious downside in operation is that the external box with its own PSU is bloody noisy.

As for actual gaming performance, well, it's much as you'd expect, whether you're using it like a laptop with the internal GPU or as a desktop with the graphics box, in both scenarios backed-up by a nice Intel quad-core Haswell processor. Which is to say, it genuinely works.



And what of the Alienware 15 as a laptop in its own right? Well, it's certainly a nicely engineered lump with a particularly solid and pleasing keyboard. Depending on usage, you're looking at a good three hours or so of battery life. If there are negatives, they involve the 15-inch 1080p LCD panel, which is merely adequate, and the stingy 128GB SSD. Yes, there's a 1TB magnetic drive, but we'd want more storage of the solid-state variety.

If at this point you're sensing positive vibes about the Alienware 15, you'd be both right and wrong. On the one hand, this thing definitely works. However, what completely blows it out of the water as a proposition is the lofty pricing. It's so expensive as an overall package that it simply makes no sense. You'd be far better off just running a proper desktop.

That's especially true these days with everything being up in the cloud, in software terms. Simply run Steam and a synced web browser on both boxes, and you've reduced the advantages of having a single box to do it all pretty much to nil.

–**JEREMY LAIRD**

VERDICT 7

Alienware 15 with Graphics Amplifier

+ NICE SOLUTION It's a complex setup but it really works; allows for future graphics upgrades; has decent portable performance.

− WRONG PROBLEM So expensive that you may as well just have a desktop and a laptop; mediocre screen quality.

£2,000 (estimated), www.dell.com

SPECIFICATIONS

Screen	15-inch
Resolution	1920 x 1080
CPU	Intel Core i7-4710
Memory	8GB DDR3
Internal graphics	Intel HD 400, Nvidia GTX 970M
External graphics	AMD Radeon R9 290X
Storage	128GB Samsung M.2 SSD, 1TB WD magnetic drive
Warranty	One year

BENCHMARKS

	Alienware 15	Alienware 15 with Graphics Amplifier	MSI GS30	MSI GS30 with Gaming Dock
Cinebench R15 (index)	639	**654**	612	636
X264 v4.0 (fps)	**39**	**39**	35	37
Heaven 4.0	8 / 43	19/60	4/6	**27 / 75**
Bioshock Infinite	12 / 70	12 / 94	2 / 9	**17 / 120**
GRID 2	54 / 68	55 / 66	13 / 8	**130 / 165**
Metro: Last Light	15 / 32	25 / 48	3 / 6	**27 / 53**

Best scores are bolded. Game scores are minimum/average fps.

AMD
065 TT 49
ALIENWARE

Alienware's Graphics Amplifier really works, but it will cost you.

Mid-range stereo gaming headset, but is it good?

Razer Kraken Pro

Bass, bass, buttery biscuit bass

WHAT IS IT WITH RAZER and just not doing so great lately? If there was ever a time for it to shine, you'd think it would be now. After years of research and development, it should be winning hearts and minds with its LED-encompassing peripherals of power. However, that's simply not the case. That's not the way the cookie crumbles, and nowhere is this more apparent than with the Razer Kraken Pro.

Headsets have come a long way over the last decade. And even though this variant of Razer's prestigious Kraken series is priced competitively, at around £65, it just doesn't hold its own when compared to solutions from competitors such as QPad, Steelseries or Asus. It suffers from 'gamer's syndrome'. What do we mean by that? Simply put, too much bass.

For some reason, many peripheral manufacturers have a tendency to lean too heavily on the bass production side with their headsets. And although this is great if you're looking to have dubstep playing at max volume constantly, it just doesn't cut it if you're looking for high-quality audio fidelity. This may be news to Razer, but a well-rounded headset consists of mastering not only the lows, but also the mids and the highs. The treble and the mids are just as important as the bass.

Even in gaming, you need to hear the crunch of the explosions, the gun shots, the clash of swords, not just the dull thud of the bomb going off as it reverberates around your ear lobes, slowly caressing them into heart-attack oblivion. If you're looking to get these headphones for well-rounded sound reproduction, don't. Unless, of course, bass-heavy noise is your thing. In which case, these could be for you.

However, it's not all doom and gloom for poor old Razer. The headset is a lovely fit. There's just enough tension, meaning that even after long periods of listening to music or gaming, it's still exceedingly comfortable. The earcups are a little small, though they do entirely surround your ears (as long as they're fairly small). Razer also provides an extension cable to ensure you have enough room to manoeuvre.

COULD BE WORSE

The headset looks pretty stylish too. The white finish for this particular special edition makes it a solid-looking piece of kit. But unfortunately, you still wouldn't want to wear these things in public. Even with the retractable microphone, the garish Razer typeface littered across the top of the headband makes you feel like a bit of a pillock – not a design choice we're fans of here, but ho hum. The retractable mic is a fantastic addition, and has extensive noise-cancelling features, so much so that in some cases we couldn't get it to register sound at all. You might need to fiddle around to actually get it to pick up your own voice, but all in all, it's quite the challenge just to register any noise on the poor thing, even in a busy office environment.

Ultimately, these headphones just don't provide a compelling offer to anyone who's looking at Razer for more than brand worship. They don't provide good sound reproduction, the microphone is flakey at best, and, if you have ears even slightly more than average-sized, you're going to struggle to fit them comfortably around your lugs. The extension-capable, retractable mic and four-pole adaptor for mobile usage are nice additions, but they're just not enough to redeem the Kraken of its prior sins. When there are better, cheaper alternatives out there, such as the Kingston HyperX Cloud Gaming or QPad's QH-85, we're genuinely confused as to what Razer is playing at here. **–ZAK STOREY**

VERDICT
5

Razer Kraken Pro

+ CRACKING Handy extension cable; four-pole adaptor; retractable mic.

– CRACKED Poor sound quality; no memory-foam padding; garish typeface design; flakey microphone.

£65, www.box.co.uk

SPECIFICATIONS

Driver size	40mm
Frequency response	20-20,000KHz
Weight	300g
Cable length	1.3M (3.3M with splitter adaptor)
Connection type	3.5mm headphone/mic + four-pole adaptor for mobile
Mic	Unidirectional

Samsung U32E850R

A flawed masterpiece for lots of money

CALL IT ULTRA HD. Call it 4K. Either way, it's a metric tonne of pixels and simultaneously seductive and very silly. It's seductive in a way that only really big numbers and cutting-edge tech can be. Eight millions pixels on a PC display? Extraordinary.

The silliness comes when you chase 4K resolutions without fully understanding the pitfalls. Allow us to pontificate. The first issue involves pixel density and DPI scaling. Even Microsoft's latest and greatest Windows 10 OS doesn't scale well across multiple DPI settings. Bump the DPI up from 100 per cent and things look borky.

Moreover, even if Microsoft got its DPI house in order, you'd be waiting for the whole internet to catch up. And that's not going to happen overnight. The upshot of which, for the foreseeable future, will be clunky looking bitmap graphics and images when non-native DPI settings are used.

The other issue is graphics performance. Those eight million pixels need pumping at 40 or so times a second, as a bare minimum. That means at least 320 million fully textured, lit, bump-mapped, occlusion-culled and anti-aliased pixels. Every flipping second. Yikes.

Meanwhile, the new generation of 34-inch super-wide monitors does a pretty good job of competing with 4K for raw detail and pure visual majesty, while giving your graphics that little bit of critical breathing room. As a pure gaming device, then, arguably no 4K monitor currently makes sense. However, if your remit is broader and you're willing to take a long-term view and wait for GPU performance to catch up, then going 4K right now just about adds up. And so enter Samsung's latest 4K competitor, the U32E850R.

PANEL BEATER

Straight out of the box, it side steps the whole DPI issue by virtue of spanning 32 inches. That's just big enough to allow you to run the DPI setting at 100 per cent without fonts, icons and other elements becoming too small for comfort. In that context, the big price premium over the current generation of 27- and 28-inch 4K monitors is tolerable.

Where things get trickier is compared to the go-to 4K monitor of the moment, namely Philips's BDM4065UC. It's a full 40 inches, but sells for as much as £350 less than this Samsung panel. Youch.

But hang on, because the Samsung has some weapons up its sleeve. For starters, it's a much better quality LCD panel. The slightly over-warm default colour temperature aside, the Samsung is a thing of real beauty. The colours don't just pop, they positively explode. The viewing angles are much better than the Philips's. Ditto the black levels. Thank the lovely PLS panel tech for all that.

What's more, the Philips suffers some pretty obvious issues, including vertical interference-related banding. But then the Philips is, at heart, a little bit of a skanky HDTV-to-PC-monitor conversion and ultimately that shows. This Samsung, on the other hand, is a quality item through and through, and that shows, too.

Just to sweeten the deal, the U32E850R also sports support for AMD's Freesync adaptive-sync tech. Unfortunately, try as we might, we couldn't get it working. Odds are that's an AMD driver issue. What isn't a driver issue is this screen's inability to auto-detect signal inputs and wake itself up. We had to do that manually, which gets old very quickly. All of which makes this flawed masterpiece a bit marginal for the money.
–JEREMY LAIRD

VERDICT
7

Samsung U32E850R

+ STUNNING VIEW Glorious PLS 4K panel; just big enough to avoid DPI issues; supports adaptive sync.

– WINDOWS VISTA Very pricey; no high-refresh support; FreeSync is buggy; doesn't wake up properly.

£825, www.samsung.com

SPECIFICATIONS

Screen size	31.5-inch
Panel type	PLS
Native resolution	3840 x 2160
Viewing angles	178/178 degrees h/v
Contrast	1,000:1
Brightness	300cd/m2
Response	4ms
Max refresh	60Hz with FreeSync support
Inputs	DisplayPort, MiniDisplayPort, HDMI

SAMSUNG
MONSTER ENERGY
PASSION
KJØRFORLIVET.no
ADRENALIN

Samsung's latest 4K display sports a glorious PLS panel.

EK Water Blocks Predator 240

Could this be the new king of the water-cooling jungle?

IF YOU'VE SPENT any amount of time around the depths of the custom water-cooling world, you'll have come across one name in particular – EK Water Blocks. Along with Bitspower, EK is one of the most popular water-cooling componentry firms globally. And for good reason. Providing top-notch cooling capacity and an aesthetic design style so clean you could eat your dinner off of it, it's easy to stick with EKWB throughout any of your water-cooling projects.

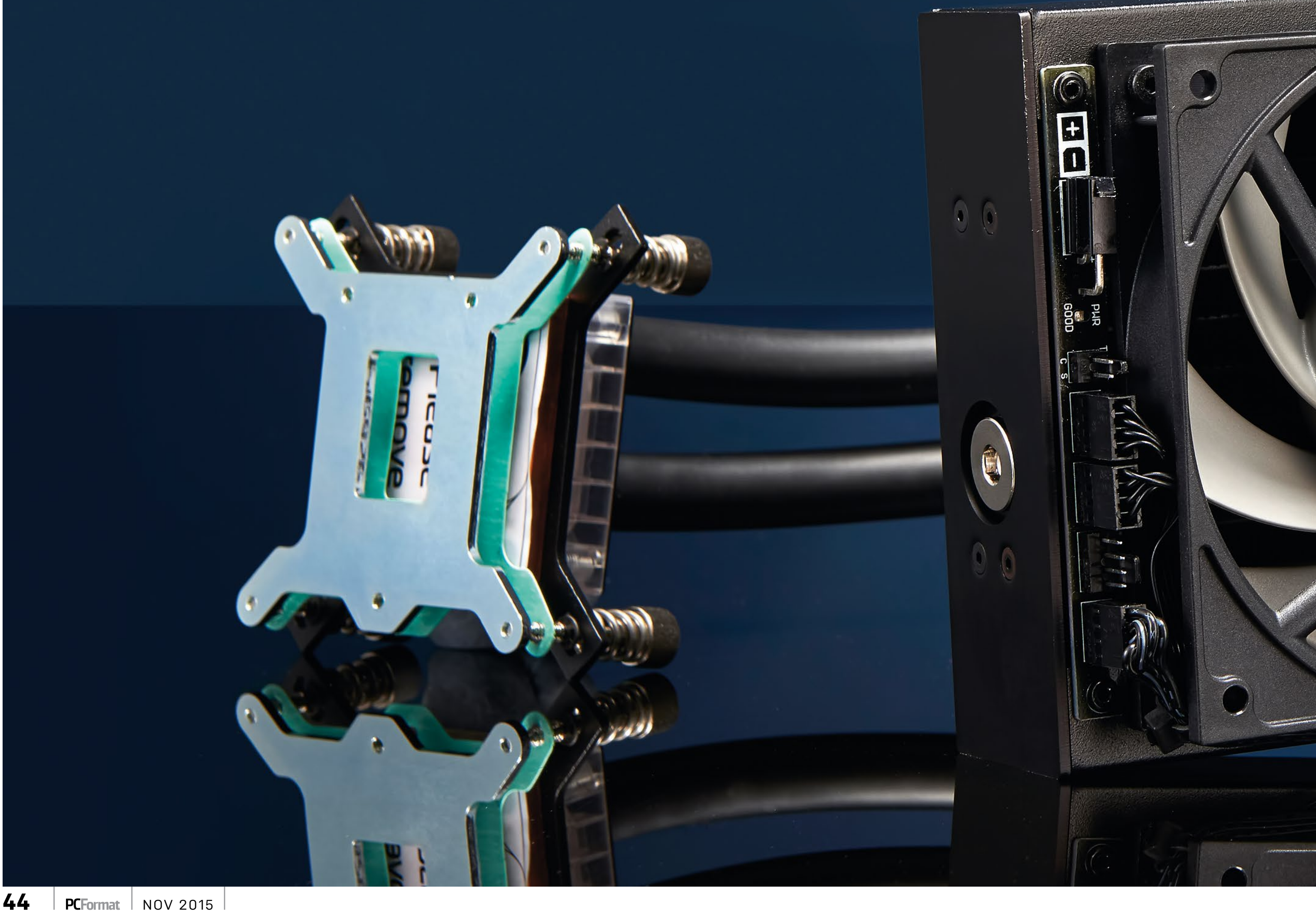
That being said, not everyone is into water cooling an entire system. After all, the mixing of water with electricity has rarely ended well. Even water of the deionised variety has a habit of exploding over many a lovely system. Despite that, however, offloading our woes into an all-in-one closed-loop cooler has become undeniably popular. So let's leave the worry and the warranty to companies such as Corsair, NZXT and Thermaltake, all of which provide some very impressive and easy-to-install cooling solutions. Indeed, it's about time EKWB finally tapped into that market. And boy, has it.

The Predator is the culmination of everything that enthusiasts have ever wanted from a 240mm all-in-one liquid cooler. You get one of EK's 240mm radiators, coming in at 38mm thick. Slightly thicker than a Corsair H100i, the radiator boasts a fin density of 38FPI (fins per inch). That means you'll need some seriously beefy fans to power it. But don't worry, EK has you covered, with the inclusion of two of its custom-designed Vardar high-static pressure fans. Plus, an integrated pump and reservoir unit is situated at the top of the radiator, while an Evo Supremacy CPU block is connected to the bottom of the expandable tubing, complementing the whole unit nicely.

MOD TO THE MAX

Okay, so it sounds like every other combo we've seen, right? If just a little beefier. Well, sort of. The design of the Predator has some nifty new features, a few of which we haven't seen in the AIO world before.

One of the more innovative additions is, in part, thanks to the positioning of the pump and the fans. All of the power cables, fan connectors and pump controls are located on the radiator itself. This means you can avoid all that awful cable management nonsense around your CPU block, and instead route the cables around the back of your chassis instead. Also, the loop is entirely expendable. If you want to change the tubing for clear tubing, you can. Fancy putting some better fittings on



there? You can do that, too. You can also grab a GPU water block and throw that into the mix if you really want. On top of all of that, EK is bringing the first commercially available 360mm-edition radiator to the UK, which also includes quick disconnect fittings, allowing you to swap out hardware and other pieces of tech quickly and easily.

Ultimately though, it's the performance that matters most. We tested the Predator against our current favourite, the NZXT Kraken X61, and saw, at most, a total of 1-2 degrees difference between the two. When you consider the Kraken has a total surface area of 280mm, versus the Predator's 240mm, that's a serious achievement.

Sounds like this is heading for a top-score review, right? Not quite. For the most part, the mounting system is very difficult to attach to the motherboard. On our Skylake CPU, we found you had to remove the backplate entirely (which also included removing the socket brace). You then had to reattach it with EKWB's included backplate. It remains uncertain whether this will be the final mounting system, but it's incredibly fiddly, to say the least. You also have the potential to possibly damage your pins when you do this, so it's something to bear in mind.

All in all, the Predator is a phenomenal piece of kit. Although the mounting system could do with some improvement, it's nice to see EKWB expand and improve in an enthusiast area that's otherwise become a little stagnant.

–ZAK STOREY

VERDICT

8

EK Water Blocks Predator 240

+ WITH ARNIE Powerful performer; innovative and interesting design; silent; looks great; expandable.

− WITHOUT ARNIE Price; mounting setup; only Intel support.

£169, www.overclockers.co.uk

SPECIFICATIONS

Dimensions (including fans)	295 x 133 x 68mm
Stock Fans	2x 120mm PWM EKWB Vardar Fans
Socket support	Intel only
Additional fan support	2x 120mm

BENCHMARKS

	EKWB Predator 240mm @ 4.8GHz	EKWB Predator 240mm	NZXT Kraken X61
Idle temp (°C)	23	22	**21**
Prime 95 load temp (°C)	86	**66**	67
Cinebench R15 load temp (°C)	74	**55**	56
FireStrike Ultra (4K) load temp (°C)	64	**52**	**52**
Star Citizen Hangar Walk (°C)	61	**51**	**51**
Shadow of Mordor (°C)	63	**50**	**50**

Best scores are bolded. Tested using an Intel Core i7-6700K and Windows 10 64-bit, all power saving turned off. Temperatures measured after five minutes or after benchmark completion.

Vardar
Predator
Model: F4-120ER (2200rpm) DC12V 0.18A ENGINEERED IN SLOVENIA WEEE: DE 55596098
Vardar
Predator
Model: F4-120ER (2200rpm) DC12V 0.18A ENGINEERED IN SLOVENIA WEEE: DE 55596098

The Lamborghini of the water-cooling world.

Nvidia Shield

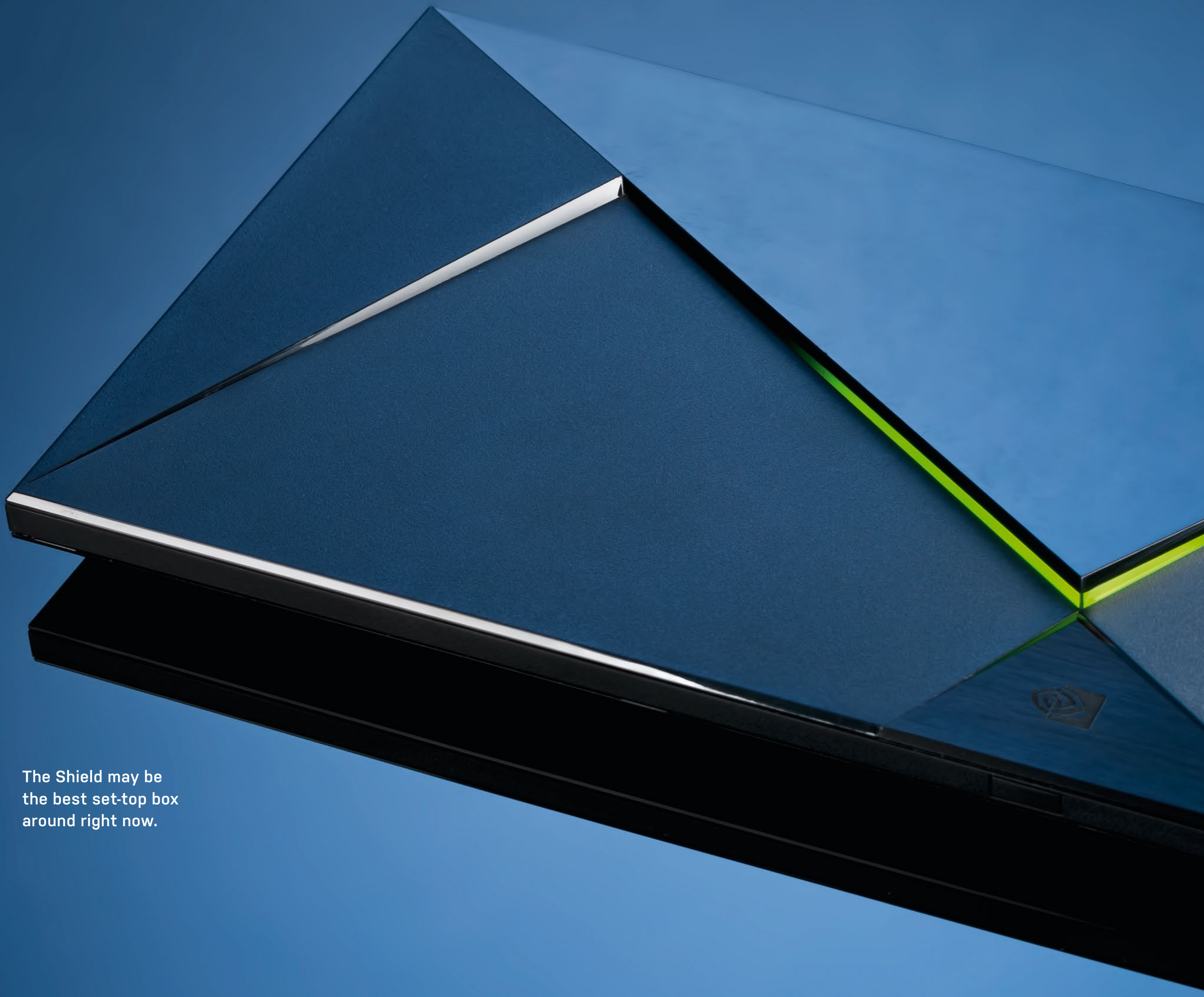
More Android TV than game console

THE 2015 NVIDIA SHIELD marks the third entry into the company's Shield lineup. Confusingly, Nvidia is once again simply calling this iteration 'Nvidia Shield'. Because of its new form factor, many are referring to it as the Nvidia Shield gaming console. But in our opinion, it's more of a set-top box than a gaming machine.

The brains behind the operation is Nvidia's new Tegra X1 SOC, but it's Google's Android TV UI that's really at the heart of this device. The Shield's main purpose here is for watching movies and TV shows, plus gaming. This means there's no full web browser and no email client. As a matter of fact, many of the Google Play apps are walled off, and only curated Android TV apps are downloadable from the Google Play store on the device.

Measuring 25 x 210 x 130mm, the Shield is smaller than you'd expect. The little device is running Android Lollipop and has two USB 3.0 ports and an Ethernet port. Our unit came with 16GB of internal storage. That isn't much, but, considering most Android games and apps are quite small, coupled with the fact it has a microSD card slot, it isn't the end of the world.

Setting it up is pretty easy. You simply log into your Gmail account with the included



The Shield may be the best set-top box around right now.

wireless Shield controller, essentially the same controller that Nvidia packaged with its Shield tablet last year. You'll be using the controller's built-in mic a lot, as Android TV is largely designed around voice commands. If you don't want to use voice commands, there's also an onscreen keyboard. As a movie/video-watching machine, the Shield is the best set-top box out there. It supports Hulu, Netflix, Plex, Kodi, YouTube and more. The device also acts as a Chromecast. To top it off, the box supports 4K video at 60fps over HDMI 2.0.

When it comes to gaming, the Shield is largely a mixed bag. When we reviewed the original Shield portable back in 2013, we complained that triple-A Android games were few and far between. The situation hasn't improved much in the past two years. Sure, there are some decent Android titles about, but most of them are casual games or are ports of existing console/PC games.

To mitigate the dearth of deep Android games, Nvidia is pushing its Grid game streaming service. Right now, there are about 60 streamable PC games. You'll need a good internet connection, however, and we'd recommend a 5GHz router. The Shield also lets you stream from your gaming PC, as long as you're on the same network. This doesn't, however, work as well as Valve's own In-Home Streaming service, as it only officially supports a couple of titles.

GAMING LIMITATIONS

The Shield's X1 chip is a quad-core 64-bit SOC based on a 20nm process. In conjunction with its SOC is 3GB of RAM. Unfortunately, the Shield's closed-off Android TV ecosystem doesn't support that many benchmarks, so we only had a handful of comparisons to go by.

In GFX OpenGL, an OpenGL graphics benchmark, the Shield garnered 43fps in the 'Manhattan' test. We used our Shield Tablet as our test rig, and Nvidia's 2014 tablet's 2.2GHz K1 processor only managed 29fps. For a compute benchmark, we used CompuRS to calculate megapixels per second picture rendering. The Shield garnered a score of 4.7MP/s, beating the Shield tablet by 104 per cent. Synthetic tests out of the way, we fired up *Tainted Keep*, an Android hack-'n'-slash game with a built-in benchmark. Here, the Shield scored an average 57.9fps in the extreme benchmark, whereas the Shield Tablet, again, got roughly half that frame rate.

While the Shield is able to handle most games well, it's still a mobile chip and does have its limitations. We fired up *The Talos Principle*, which is a port of the PC first-person puzzle game, and even at its default 1080p settings, the game struggled to run with a smooth frame rate and was downright choppy at times.

The Shield may not be our first choice for a gaming system, though you can certainly have tons of fun with it. Its real power lies in its strength as a media player; it's the most impressive set-top box we've seen to date.

–JIMMY THANG

VERDICT 7

Nvidia Shield

+ METAL SHIELD Small and sleek; awesome media player; good peripherals; easy to use.

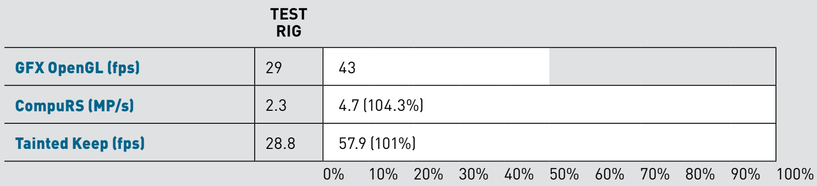
− WOODEN SWORD Lacklustre Android games; local game stream issues.

£130 (estimated), www.nvidia.com

SPECIFICATIONS

SOC	Nvidia Tegra X1 with 3GB of RAM
Size	25 x 210 x 130mm
Weight	654g
Storage	16GB
Ports	Gigabit Ethernet, HDMI 2.0, 2x USB 3.0, micro-USB 2.0, microSD slot

BENCHMARKS



	TEST RIG	
GFX OpenGL (fps)	29	43
CompuRS (MP/s)	2.3	4.7 (104.3%)
Tainted Keep (fps)	28.8	57.9 (101%)

Our test rig is the Nvidia Shield tablet, which uses a Tegra K1 SOC clocked at 2.2GHz with 2GB of RAM.

TALKING

BY **JIMMY THANG**

The Reality of HoloLens Draws Near

PCF talks to Microsoft's AR mastermind

The tech world has excitedly watched virtual reality's ascent, so it was a big moment when Microsoft announced its augmented reality contender, the potentially game-changing HoloLens, earlier this year. Eager to learn more, we spoke to Microsoft corporate vice-president Kudo Tsunoda, of Kinect fame, who has now taken the HoloLens reins.

HoloLens will really change the way people communicate, work and play, says Tsunoda.

PC Format: Can you tell us more about HoloLens?

Kudo Tsunoda: Sure! HoloLens is a fully untethered holographic computer, powered by Windows 10. What that means is that instead of having your digital apps – digital assets – locked to the boundaries of screens, we're able to break them out, turn them into holograms and put them right into your real world.

This has some amazing applications, and will really change up the ways people can communicate, the way they can work, the way they can learn. One of the things we found, now that you're able to create 3D assets in 3D, is that people can get in and sculpt their own holograms. It's really unlocking people's creativity in a new way. I'm just happy to show off how holograms can really impact the world of gaming.

PCF: Can you delve into the specs? When's it coming out? How much will it cost?

KT: We haven't announced a time that we're shipping, or a price yet. As far as when it ships, it's in the Windows 10 timeframe, so it's definitely not years in the future. Holograms are something I've always thought were more like science fiction that's going to happen way in the future, but we've got working units. It's definitely not years in the future.

PCF: One of the biggest complaints from the early model was the field of view. Can you talk a little bit about how you're tackling the FoV with the HoloLens?

KT: We're not talking specific degrees yet. I think a lot of the time, the questions you'll get is, "Hey, what is the difference between mixed reality and virtual reality?" Obviously, mixed reality being more of blending your digital assets with your real world; virtual reality being more of a fully immersive experience. And so you get asked lots of times about FoV. "Hey, is the FoV for HoloLens ever going to be this fully immersive panoramic kind of view?" And it's not, because it's definitely different technologies, different things that you're trying to do.

As wanting to incorporate the real world and the holograms together, we're not going to build a fully immersive digital kind of experience like you'd see with virtual reality, so it's different technologies that do different things, and you know we'll have a different field of view for sure.

TECH

HoloLens has no release date, but it will launch within the Windows 10 timeframe.

PCF: So, you haven't locked down what the final FoV will be?

KT: That's right.

PCF: Do you know what it is right now?

KT: I don't have the exact degrees. In general, it's not those types of specifications and stuff that we're putting out. We really want to stay focused on the experiences and what you can do with the holograms, more than just the tech specs.

PCF: We were really blown away by the fact that when the HoloLens projected something on the table, we could barely see the table behind it. Could you delve into the secret sauce?

KT: Yeah, I mean, it's really custom optics that we build to allow you to see the holograms. We want the holograms to feel like they're real-world objects. So, that's part of not only what we do visually, but just making sure that when we put a hologram into the world, that it sorts properly with all the real-world physical objects.

There's also stuff we do with our spacial audio systems. So, without having any kind of headphones, we're able to provide you with a 360-degree spacial audio soundscape: When you have holograms behind you and the holograms make a noise, you can hear the sound coming from behind you, with no headphones at all.

I think those are all parts of the things that we do to make holograms feel like a part of your real world, something that you can count on as being persistent in your world, and really giving people a fun time, having fun playing with holograms.

PCF: Just to reiterate, it's going to be a self-contained Windows computer on your head, right?

KT: That's right. It's completely untethered. You have no cords or cables tied to other devices. There's no use of any other markers, or any other cameras, or anything else you have to put in the environment. Everything that you need to see and hear holograms with is all contained in Microsoft HoloLens.

PCF: Have you guys talked about the specs at all? Something like that needs to be light and powerful, with great battery longevity, surely?

KT: One of the big things we had to do, because there are so many different sensors and pieces of technology and data coming into the device, that allows us to have the holograms pinned to your real world, is that we did have to create a custom piece of silicon. Our holographic processing unit.

That's one of the great things about working at Microsoft. You can take problems that are seemingly impossible, like putting holograms into the real world. When you've got the amazing, talented team of people at Microsoft, we're able to do these kinds of things, and make them happen.

PCF: So, you guys aren't using an Intel processor or anything like that? It's all fabricated in-house at Microsoft?

KT: No, we have one piece of custom silicon called our holographic processing unit. And then, you know, we're not really talking about the particular chips or anything else we're putting in the device today.

PCF: More recently, you guys are jumping into the PC bandwagon a lot more for gaming. Can you talk about that initiative? What was the turning point for that?

> "We've got working units. [HoloLens] is not years in the future."

KT: Everything we're doing with Xbox is a big focus on providing a high value for gamers. Finding out from our fans and finding out from our community what gamers really want, and what they're looking for. And as far as what we're doing for Windows 10, you can see a game like *Fable Legends* that is enabling crossplay between Xbox One and Windows 10 PCs.

So, a game like *Fable Legends*, it'll ship on both platforms. If you're on Xbox One, you can play with or against people on Windows 10 PCs, and vice versa. I think that's one of the big pushes. Gamers want to play games with the people they want to play with. It shouldn't have to matter, "Oh, are you on PC or are you on console?"

I think for too long there's been that PC gaming kind of community and the console gaming community. They're all people who love playing games so they should be able to play games together. That's one of the big pushes we're doing with Windows 10. It's just trying to bring those communities together, so we can all play games together and have fun. And also, I play games on every device I have. You want to be able to play the games you love on these different devices.

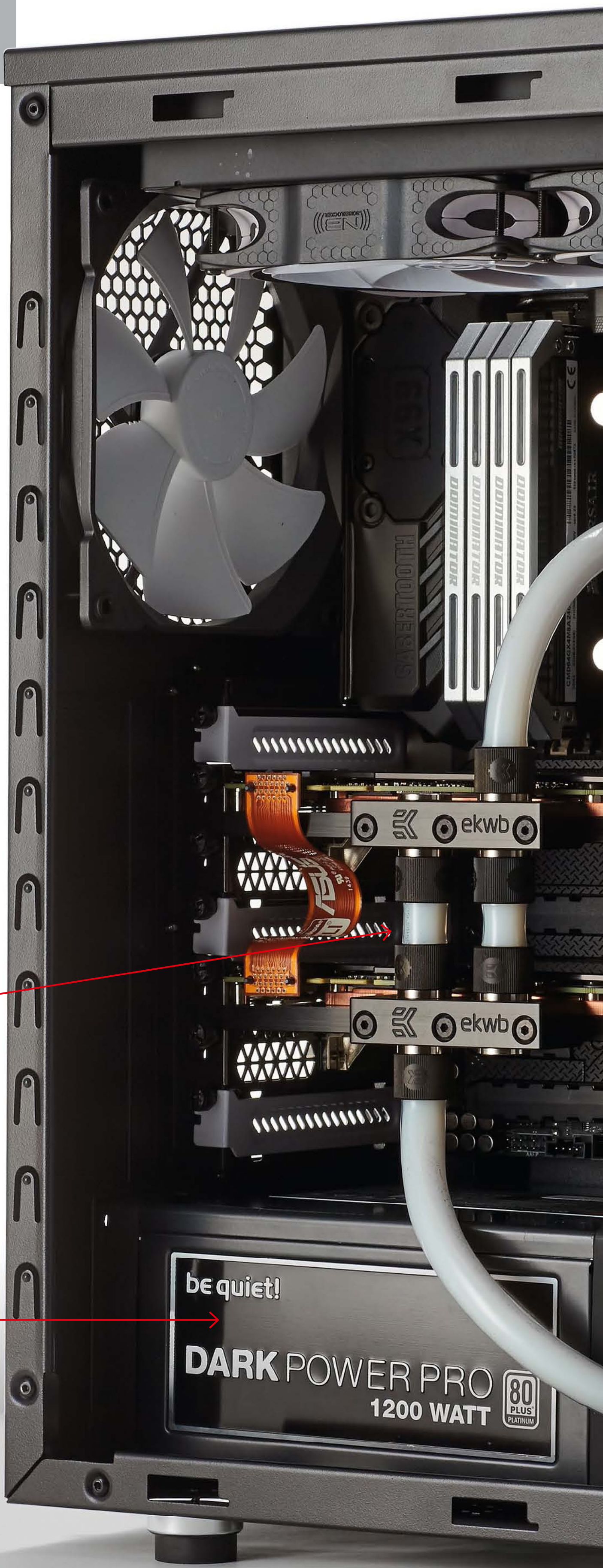
When I'm at home, I'm playing on my console on my big screen TV. But then, you know, if I'm going to work, or... well no, Christ, I'm not playing games at work! I'm at Microsoft working, but if I'm at work and I've got my Windows 10 PC there, I can now go in and just start playing *Fable Legends* on my PC and have everything that I've earned or anything that I've bought while playing *Fable Legends* on my console, just work seamlessly on my Windows 10 PC. ■

Tech Porn

PC Format Water-Cooled Gaming PC

WE ARE PC GAMERS, and PC gamers demand the best that their bank accounts can muster. Well, no. Sort of. It's usually whatever money we have left over from our other activities… but you get the point. For the enthusiasts among us, the first step is to get hold of an all-in-one cooler. Then maybe some braided cables and LEDs. Then, finally, jump into the murky depths of water cooling.

That's exactly what we did here, and damn, does it look good. We threw in an Asus X99 Sabertooth and an Intel Core i7-5820K, alongside 64GB of Corsair Dominator Platinums and two EVGA GTX 980 Ti's to produce one number-crunching benchmarking machine. And boy, does it perform! Fancy 4K gaming at ultra 60fps? No worries. The biggest problem we had was deciding whether we wanted a 1440p, 144Hz monitor or a 4K, 60Hz one. Anyway, enough words, enjoy! –ZAK STOREY

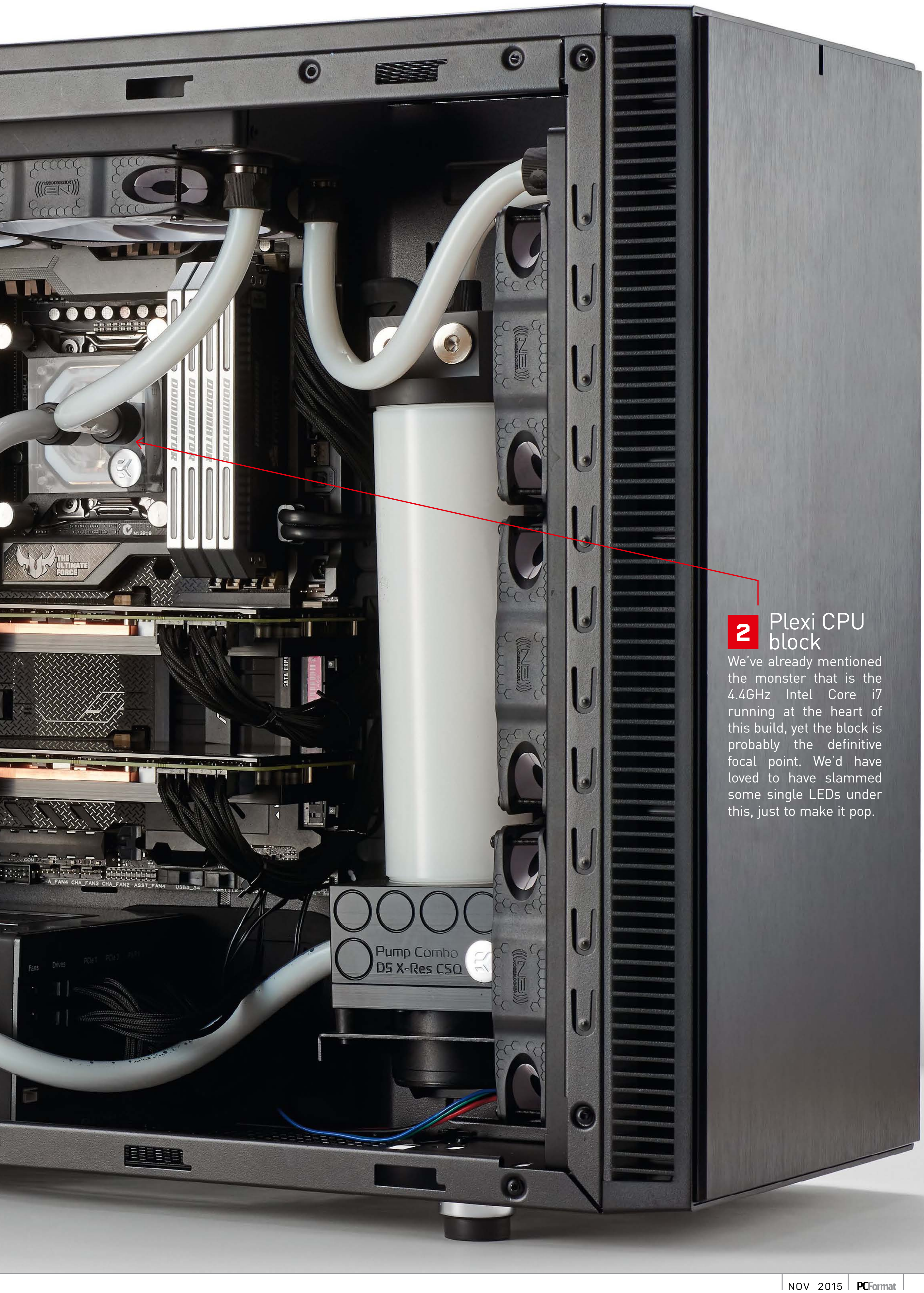


1 Graphics card bridge

Probably one of the hardest parts of this build was fitting the GPU bridge. You can get plexi block covers, but we opted to use tubing instead. However, wobbling two £500 cards onto one another to get this to fit was a little terrifying.

3 Power supply woes

Speaking of popping, this was actually the second power supply we got through. Although it's been running as our daily driver for the last three months, for some unknown reason (no water was involved), it gave up the ghost just as we'd finishing shooting day one.


THE ULTIMATE FORCE
DOMINATOR
Pump Combo
D5 X-Res CSQ
SATA EXPR

2 Plexi CPU block

We've already mentioned the monster that is the 4.4GHz Intel Core i7 running at the heart of this build, yet the block is probably the definitive focal point. We'd have loved to have slammed some single LEDs under this, just to make it pop.

RIG BUILDER

BY DAVE JAMES

Build Your Perfect PC

Whether you're upgrading your PC or starting anew, this is the best kit

ONE OF THE JOYS OF OWNING A PC is that you can upgrade it as you go. Need higher frame rates in games? Drop in a newer graphics card. Want more power elsewhere? Grab a new processor or go for that old favourite: the memory boost. There's a wealth of upgrades that can transform your machine, plus you can change slowly over time to suit your budget, so you rarely have to suffer a sluggish rig for long. Every now and then, the best possible upgrade is to dump your current rig and start afresh by building a whole new machine from scratch.

What sort of machine should you build, though? Which items are important? Which work well together? How much should you be budgeting for? That's a lot of questions, and getting the right answers means having to go and research all the current trends in order to make the best decision. Before you do that, though, take a look at our guide. You'll discover that we've taken the hard work out of the equation and presented you with three machines that fit three different budgets. Our budget PC will get you gaming at 1080p for a bargain price, our mainstream machine will cope with pretty much anything at 1440p, and our high-end rig will do pretty much whatever it wants…

On these pages are our recommendations for putting together those budget, mainstream and silly high-end machines. These rigs all include a screen and peripherals in the ticket price, so if you're keeping your existing goodies then you'll have more cash to spend elsewhere. And what's our recommendation if you find yourself with that pleasant problem? Either get a larger SSD or a more powerful GPU. Happy building you lovely people!

HOW TO… BUY A GPU

THE GRAPHICS CARD IS ONE OF THE biggest upgrade purchases you can make for your performance PC. It's also one of the easiest – open up the case, slot it in and power it up. Simple as juicing citrus.

So, making the right choice is vital, especially as there are so many different options around at the moment. Essentially, it's almost entirely down to your budget. Buying the most powerful single-GPU card you can afford is always a good rule of thumb, but it's always worth ensuring that your power supply is capable of feeding it enough juice and has the right connectors.

So long as your PSU has a pair of 8-pin PCIe power connectors, you should be golded, but always check that your PSU's capacity matches the recommended spec for your prospective GPU. Finally, a word on multi-GPU purchases. Beware. You can get better average frame rates, but an equivalently priced single card is always going to be a better experience.

BUDGET

MOTHERBOARD	
■ MSI B85M-E45	£48
CPU	
■ Intel Pentium G3258	£51
MEMORY	
■ Crucial 2x 2GB DDR3 1,600MHz	£20
GRAPHICS CARD	
■ MSI GTX 750 Ti OC	£100
SOLID-STATE DRIVE	
■ OCZ ARC 100 240GB	£67
CPU COOLER	
■ Intel Stock Cooler	N/A
POWER SUPPLY	
■ Silverstone Strider E 500W	£45
CHASSIS	
■ Corsair Carbide 200R	£45
OPTICAL DRIVE	
■ LiteOn IHAS124-14 24x DVD±RW	£12
SCREEN	
■ AOC E2250SWDNK	£75
TOTAL	**£463**

MAINSTREAM

MOTHERBOARD	
■ Asus Z97-A	£114
CPU	
■ Intel Core i5-4690K	£172
MEMORY	
■ Corsair Vengeance LP 8GB	£46
GRAPHICS CARD	
■ XFX Radeon R9 290	£220
SOLID-STATE DRIVE	
■ Crucial MX100 512GB	£150
CPU COOLER	
■ Enermax ETS-T40	£38
POWER SUPPLY	
■ OCZ ModXStream Pro 500W	£65
CHASSIS	
■ Cooler Master CM690	£52
KEYBOARD	
■ Corsair Vengeance K65	£59
SCREEN	
■ Viewsonic VX2363Smhl	£125
TOTAL	**£1,041**

HIGH-END

MOTHERBOARD	
■ Asus X99 Deluxe	£292
CPU	
■ Intel Core i7-5960X	£800
MEMORY	
■ Corsair Vengeance LPX 16GB	£101
GRAPHICS CARD	
■ Nvidia GeForce GTX Titan X	£796
SOLID-STATE DRIVE	
■ Intel SSD 750 Series 1.2TB	£804
CPU COOLER	
■ Cooler Master Nepton 240M	£77
POWER SUPPLY	
■ CM Silent Pro Gold 800W	£135
CHASSIS	
■ CM Cosmos 2 Ultra	£300
KEYBOARD	
■ Corsair Vengeance K70	£113
SCREEN	
■ Philips BDM4065UC	£550
TOTAL	**£3,968**

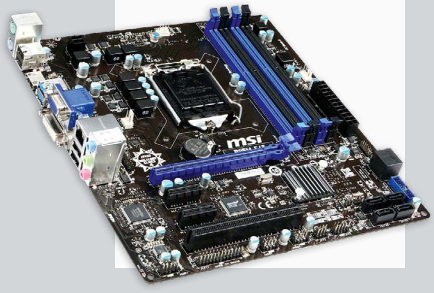
BUDGET

When every pound counts, spend them wisely

MOTHERBOARD

MSI B85M-45

With the change in Gigabyte's previously impressive B85M-D2V we've switched to the slightly better MSI board for our budget build.



CPU COOLER

Intel Stock Cooler

The Pentium Anniversary chip is a very cool-running CPU, even when overclocked. We managed a stable 4.2GHz on this stock Intel cooler.

MEMORY

Crucial 4GB 1600 DDR3

Memory pricing continues to be incredibly volatile, but it's still a great time to squeeze more sticks into your rig. You really should see 4GB as the minimum.

GRAPHICS CARD

MSI GTX 750 Ti OC

Nvidia's budget GPU is quite a feat of engineering because of the wonderful Maxwell architecture. The MSI card is a bargain.

CPU

Intel Pentium G3258

Poor AMD, it's a clean sweep for Intel on all our recommended rigs. The latest Pentium is simply the best budget chip around right now, offering Haswell for peanuts.

SOLID-STATE DRIVE

OCZ ARC 100 240GB

OCZ's ARC 100 drive may not be the quickest, but it's great value, incredibly consistent and faster than Crucial's MX100 at this capacity.

POWER SUPPLY

SilverStone Strider E

We may be talking about a budget rig here, but it's still a hefty chunk of cash to risk on a no-name power supply. This 500W Silverstone PSU will give you peace of mind and all the PCIe leads you need.

OPTICAL DRIVE

LiteOn IHAS124 DVD+RW

We really wonder whether you actually need an optical drive anymore, but for now we'll err on the side of caution and include one in the list. Don't feel bad if you forget to buy it though.

CHASSIS

Corsair Carbide 200R

Much more impressive than its price tag may lead you to believe, the clean lines and added extras of this chassis make it the budget case to beat. An understated bargain.

SCREEN

AOC E2250SWDNK

This 21.5-inch panel has a native resolution of 1920 x 1080 and looks pretty good despite that ridiculously low price tag. It's no IPS-beater, but it'll do for half the cash.

MAINSTREAM

A stunning rig doesn't have to cost a fortune

MOTHERBOARD
Asus Z97-A

We've seen a lot of Z97 motherboards since this Asus offering landed, but nothing newer has managed to push it off this list. Great features at a great price. Simple really.

CPU COOLER
Enermax ETS-T40

Enermax has simply amazed us with this, its first CPU cooler. The performance is excellent, the price is astonishing, it's easy to fit and it isn't so big that it limits your case or mobo choices.

MEMORY
Corsair Vengeance LP 8GB

This pair of 4GB sticks will give you all the performance you could ever want, and they're in stormtrooper white. They'll only take up two slots in the board for upgrading, too.

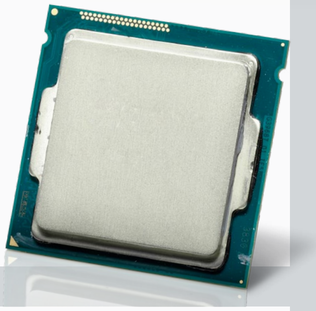
VENGEANCE
VENGEANCE

GRAPHICS CARD
XFX Radeon R9 290

In order to shift units out of the channel, AMD's top cards of the last generation have dropped in price. The R9 290 is great value, if you can't stretch to the 290X.

CPU
Intel Core i5-4690K

For almost the same price as the old Core i5-4670K, you can pick up a Devil's Canyon CPU. This still get's the nod for us over the new Skylake chips, for value if nothing else.



SOLID-STATE DRIVE
Crucial MX100 512GB

Crucial has made a big splash in the SSD market with this chunky drive. The 512GB version is quicker, larger and cheaper that the pricier M550.

POWER SUPPLY
OCZ ModXStream Pro

If you want to build a performance machine, you're going to need a powerful PSU. This 500W baby will power the rig, with extra to spare. It's quiet as well.

KEYBOARD
Corsair Vengeance K65

We love a good mechanical switch keyboard here on *PC Format*, and Corsair is making some of the best. The K65 is a great compact option, with a compact price to boot.

CHASSIS
Cooler Master CM690

The CM690 eschews silly gimmicks in favour of producing a no-nonsense chassis that has plenty of cooling options for your mainstream rig. There's space aplenty inside, and all at a reasonable price.

SCREEN
Viewsonic VX2363Smhl

The old 23-inch Viewsonic IPS seems to be EoL now, but this white one has got the budget IPS panel and decent performance for its bargain price tag.

HIGH-END

For when you *really* want to treat yourself

MOTHERBOARD
Asus X99 Deluxe

As usual this Deluxe board from Asus is absolutely stuffed with funky features. It's one of the finest, and best-looking, X99 boards around and not a bad overclocker either.

CPU COOLER
Cooler Master Nepton 240M

Why settle for a reasonable overclock when you can hit 5GHz? This kit is speedy, boasts incredible performance and is quiet in operation. Everything you'd want, in other words.

MEMORY
Corsair Vengeance 16GB

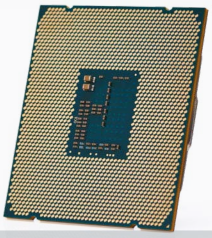
The Haswell-E platform is the first to bring DDR4 to the consumer. That does come at a hefty price, but it's damned quick.

GRAPHICS CARD
Nvidia GTX Titan X

The dual-GPU R9 295X2 is still the quickest overall card, but the GM 200 in the Titan X makes it the best all-rounder. It's almost as quick and will never suffer the ignominy of multi-GPU issues in-game.

CPU
Intel Core i7-5960X

If you're after the fastest, most advanced CPU around, then this 8-core, 16-thread Haswell-E is it. There's also the 6-core i7-5820K for a more reasonable £300, but the 5960X is the pinnacle of modern CPUs.



SOLID-STATE DRIVE
Intel SSD 750 1.2TB

Intel's latest drive is the very first consumer-focused SSD to utilise the new NVMe protocol. And that makes it super-quick, like an Extreme Edition SSD. With a price to match.

POWER SUPPLY
CM Silent Pro Gold 800W

Cooler Master continues to impress with its power supply units, and this wonderful box of tricks managed to scoop the gold award in our exacting test way back in PCF246.

KEYBOARD
Corsair Vengeance K70

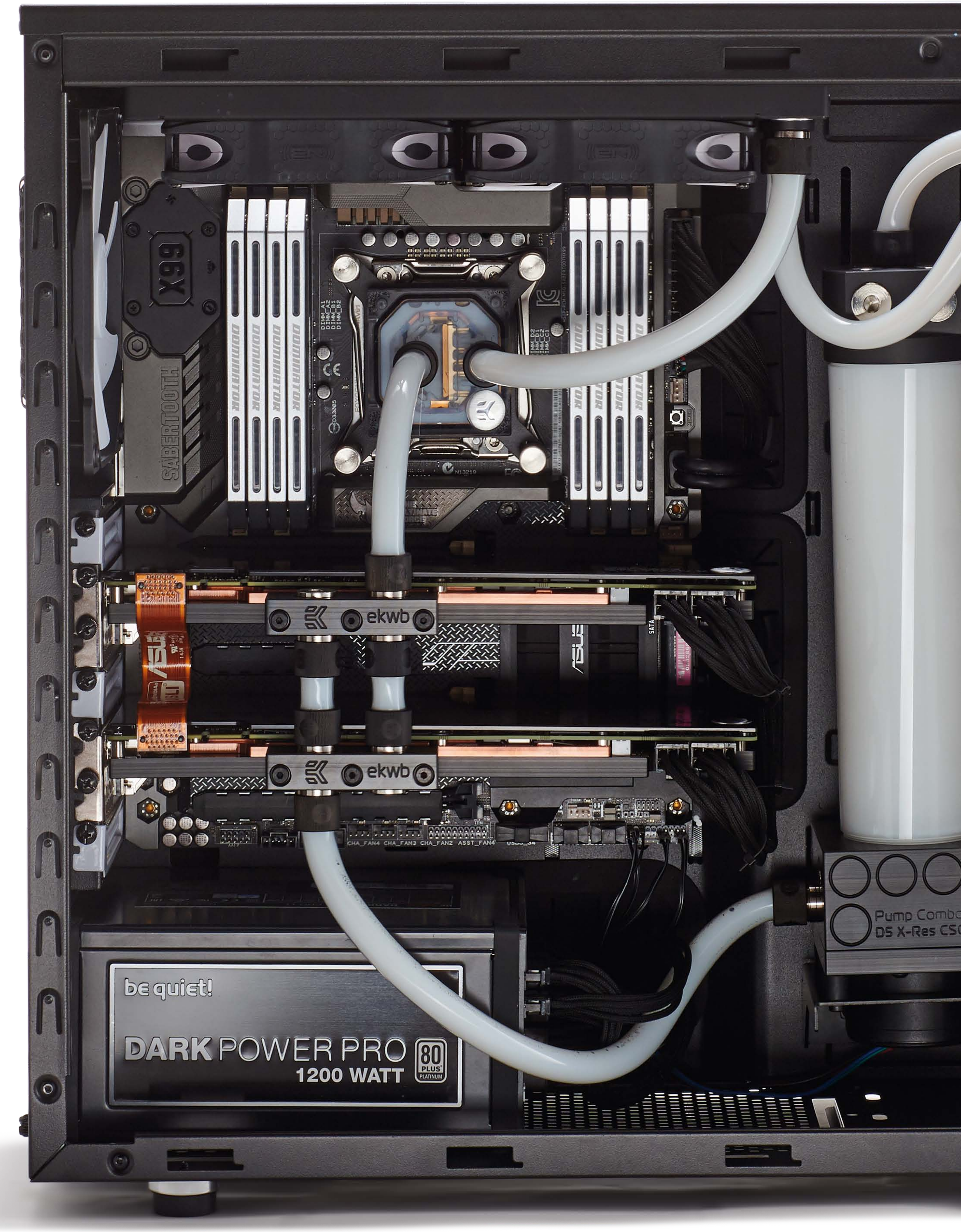
Corsair's update to the older Vengeance keyboard rights all its older sibling's wrongs. It's also a truly stylish gaming board with the red backlight glowing against its black-brushed metal chassis.

CHASSIS
CM Cosmos 2 Ultra

Cooler Master has always been an impressive maker of cases, but it has truly stunned us with this chassis. Yes, it's expensive, but if you can afford to drop this much on your case, you'll be more than happy.

SCREEN
Philips BDM4065UC

This 40-inch 4K behemoth is the first screen to make us think that super-high resolution actually looks super. It's a decent VA panel and a great price, too, and will really take advantage of the Titan X.



WATER COOLING 101

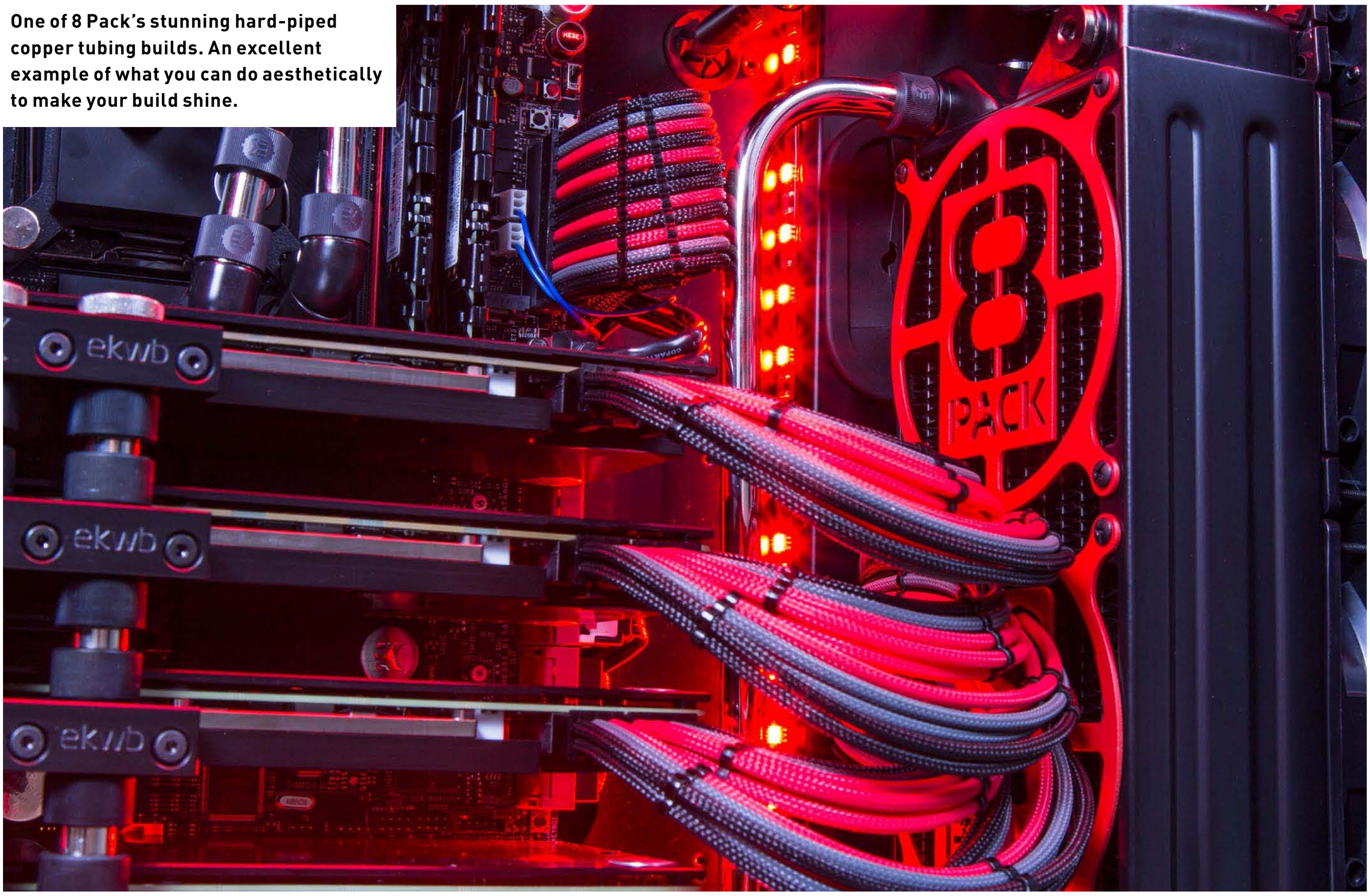
How and why to become a water-cooling master?

By Zak Storey

For much of recent history, water cooling has been shunned. Only a select few could afford to merrily dance with computing death, taking their chances with water-cooling hardware and components that weren't even designed to work in the silicon environment. They'd ghetto-graft G1/4-inch plumbing fittings onto hardware and hand-mill various water blocks, all in the hope of creating a leak-proof, watertight system. A system that could efficiently and effectively transfer heat away from their component parts, to a far greater degree than traditional air coolers ever could.

It was back in the noughties, a time when the average PC enthusiast was less concerned about how a PC looked. More important was how many frames per second they could squeeze from their beige box of dominance in *Unreal Tournament*. It was a terrifying time. But over the last five years, the situation has changed dramatically.

Water-cooling manufacturers and modding companies – such as EKWB, XSPC, Primochill, Bitspower and E22 – have come to the forefront in far greater numbers. This is when and why water cooling really began to take centre stage. Indeed, today you'd be hard-pressed to find a high-end system that's not running some form of all-in-one CPU cooler or a custom loop. Hell, all of us here at the *PC Format* office would run hard-piped builds if we could, and there isn't one of us still stuck on the retail cooler, or even an air cooler for that matter.



One of 8 Pack's stunning hard-piped copper tubing builds. An excellent example of what you can do aesthetically to make your build shine.

So, what is it that attracts people to water cooling? Why is it so much better than traditional air cooling? Essentially, all forms of cooling work on the same basic principles. You might have heard of them, they're part of the laws of thermal and fluid dynamics. No matter whether you have an air cooler or a full custom-loop setup, you're transferring heat using water from one point to the other. It then cools and circulates back around again to transfer that heat out of the system and to the outside environment again and again.

All very fancy, right? Air cooling technically isn't an accurate description of that cooling method, and neither is water cooling – they both essentially require a fan and a radiator to exhaust that heat. So, is water cooling for you? Should you dive into the murky depths of H_2O nirvana? Maybe you'll discover something about yourself along the way... Read on to find out.

WHY WATER COOL?

Let's cut straight to it. Primarily, water cooling is done to enhance the aesthetic beauty of a build. Don't get us wrong, the heat-reducing properties of multiple radiators and fans cooling your internal components is fantastic and highly efficient. But if you're looking for the most effective price-to-performance ratios, a good AIO cooler for your CPU and a triple fan-designed GPU would be more than enough to ensure you never hit any of the thermal limits dictated to us by our silicon-inducing overlords. And in today's technological climate, you're far more likely to encounter hardware-based limits, rather than temperature-based ones, in your overclock attempts.

"One of the benefits of water cooling is noise reduction."

One of the biggest benefits of water cooling, besides looking better than Gabe Newell's monthly bank statements, is the noise reduction. Simply put, noise control is all about effective fan control. It's not necessarily how many fans you have, but how fast they're spinning. Ultimately, the lower the RPM, the lower the noise output. For instance, if you take five 120mm fans and run them at 1,200rpm, and then take two separate 120mm fans and run them at 3,000rpm, we can guarantee the two fans will be creating more audible noise than the five.

AESTHETICS

Water cooling is primarily about enhancing the look of your build, ensuring your silicon shrapnel stands out from the crowd and looks as good as it possibly can. There are multiple ways of doing this with water cooling. By all means, we're not saying that air-cooled builds can't look good – there are some seriously stunning rigs out there that run on simple old air coolers. But water cooling sits at the centre of the modding community. It's responsible for most of the innovations we've seen in this area of the market. Whether that's braided cables, windowed-side panels or LED lighting, you can assume that the vast majority of these ideas originated from some modder out there ghettoing an idea onto one of their builds, and then showing it off to the masses.

So, you have four options in total when it comes to liquefying your machine. First, you could simply just use an AIO cooler. This way, you avoid the hassle of setting up any kind of crazy system, you're covered by a warranty and still gain the benefits of having a water-cooled CPU. Your second option is to go with a soft tubing loop, utilising flexible coloured or clear tubing. This is one of the most adaptable water-cooling methods as the tubing is flexible and easy to use.

The third and currently most popular option is to use acrylic tubing, most notably PETG tubing. This non-fragile, highly robust hard piping creates an entirely different look for a build, utilising

DIMM_A1
DIMM_A2
DIMM_B1
DIMM_B2
EVO
FC
THE ULTIMATE FOR

EK's Supremacy Evo CPU block provides incredible cooling with a simple mounting mechanism. We went transparent to show off our snazzy white pastel coolant.

straight lines and angles to really make your rig pop. And then, finally, there's copper tubing. It's identical in almost every way to acrylic tubing, except it's far easier to bend and a lot cheaper, too. Copper provides a good base to either nickel or chrome plate or even powder coat as well, though it's opaque. Whichever way you choose, you'll still benefit from the reduced noise and the far-superior cooling capacity that water cooling provides.

WATER-COOLING COMPONENTS

If you thought that building a custom PC was tricky enough, then we've got some bad news for you. Here's a quick rundown of what you'll have to consider purchasing on top of your standard build. You'll need: A case, tubing, radiator(s), a CPU block, GPU block(s), GPU backplate(s), memory block(s), reservoir(s), pump(s), compression fittings, angled fittings, bulkhead fittings, stop valves, coolant and fans. Once you've decided how you want to cool your rig and what chassis you want to cool your build in, then it's a simple matter of pricing the lot up, throwing it all in the basket and breaking your wallet in two as you fork out for an expensive exercise in PC modding.

CPU BLOCK

By far the most obvious component to cool your rig. You'll need to make sure you buy a CPU block that's compatible with the chip you're trying to cool. More often than not, this is just a simple difference between Intel and AMD, as the processors don't tend to vary greatly in size.

GPU BLOCK

Predictably, GPUs experience the greatest deal of variance. Both in the design of the PCB and in which graphics processor you choose as well. You'll need to make sure you buy a compatible block for your card. Some manufacturers, such as EKWB, will often include specific water blocks designed to work with aftermarket cards such as Gigabyte's Windforce, MSI's Lightning or the Asus STRIX series of cards. This may extend as far as the backplate as well, so always double check.

DISPELLING THE MYTHS

MANY FICTIONS CLOUD THE WORLD OF WATER COOLING, SO WE'VE SIFTED THE REALITY FROM THE RUMOUR

MYTH 1

If I use deionised water in my loop, then leaks won't matter or cause any damage.

Answer Unfortunately, no. As soon as the water is introduced to the system, it will begin making contact with the various metals inside of the water blocks. It will soon be picking up positive ions, meaning it'll be conductive within a couple of hours, at the very least.

MYTH 2

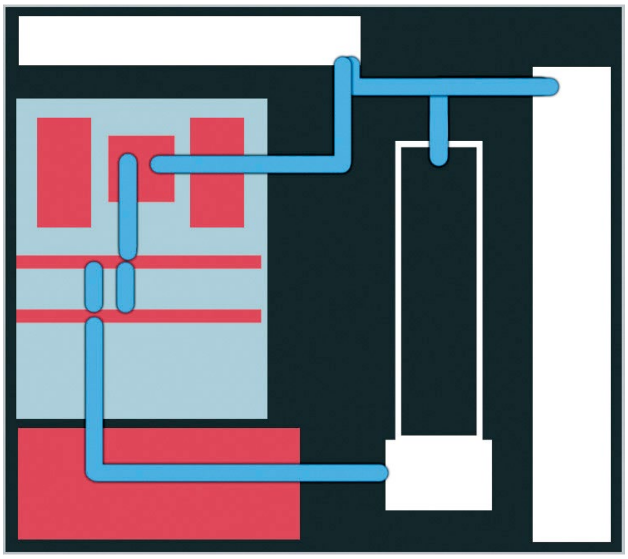
What If I blow it up when I switch it on? What if there's an instant leak?

Answer Honestly, you're seriously not going to damage anything. The best way to fill and test a loop is to make sure everything's unpowered by using a PSU bridge. By using this bridge, you can switch on just the pump and that's it. Leave this on for 24–48 hours to see if you have any leaks.

MYTH 3

If I water cool my PC and add more fans, it's going to cool down my room right?

Answer Definitely not. In fact, it's more than likely that the opposite will occur. Your hardware may run cooler, but you'll still be outputting the same amount of heat (or maybe even more if you're ramping up that overclock higher), out of the same radiators. If anything, your room will become warmer as you'll have more fans pushing more heat out of those radiators.



Even if it's just a shoddy Photoshop design, planning your build visually will save you time when it comes to figuring out how many fittings you're going to need and how best to run your cooling loops.

Making sure you've got enough space to work inside of your chassis is vital for having a stress-free, easy build.

MEMORY BLOCK

Whether or not you decide to cool the RAM with your custom loop is entirely up to you. They certainly do output heat. But really, it just looks more awesome than anything else. Besides, nobody will penalise you if all you're looking for is to cool your CPU and GPU. You'll also need compatible RAM modules that match up with your water blocks.

FITTINGS

The most important parts of your build are the fittings you choose to use. Depending on what tubing you decide upon, you'll need either compression fittings or acrylic fittings. Although acrylic fittings are still technically compression fittings, they're designed to work around hard tubing by not crushing the acrylic as much, unlike traditional compression fittings, which tend to have a greater pinch to them. If you're looking for a basic build, you can usually get away with just the standard fittings.

However, if you're looking at designing a build with cleaner lines and a little more flare, you may want to invest in some angled fittings as well, usually stipulated at 45 or 90 degrees. Additionally, a stop valve might come in handy for loop maintenance.

PUMP / RESERVOIRS

Technically, you don't need to buy a reservoir to successfully run a water-cooled loop. However, they do look rather impressive, and make it a lot easier to fill a water-cooled system than using other methods. You will, however, always need a pump to ensure that the fluid within your system is flowing, and pulling heat away from your core components and out to the radiators. Additionally, you should always have your pump gravity fed (meaning fluid should always be flowing down into it).

RADIATORS AND STATIC PRESSURE

At this point, you need to be looking at how you're going to output that heat. The only option you have is to use radiators. You can do this however you like, either by utilising separate loops for your GPUs and CPUs or by combining the two together into one single loop. But you'll still need radiators to get rid of all of that heat, and accompanying fans to reduce this per loop.

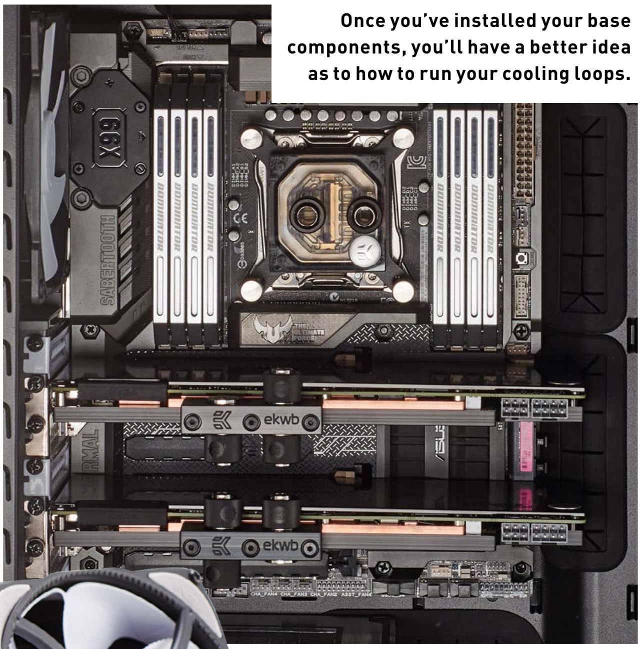
Once you've decided what space your case has for radiators and how many you're going to use, you need to take a closer look at the FPI and thickness of the radiators you'll be using. FPI stands for fins per inch. Essentially, the higher the FPI, the higher the static pressure you're going to need to effectively move cool air through that radiator. For instance, if you have a radiator with an FPI of 38, you'll probably want static pressure-optimised fans. However, if you have deeper radiators with a lower FPI of 16, you won't see any comparable difference between static pressure fans or airflow fans. In fact, in these cases, you're often better off equipping them with airflow fans instead.

WHERE TO BUY?

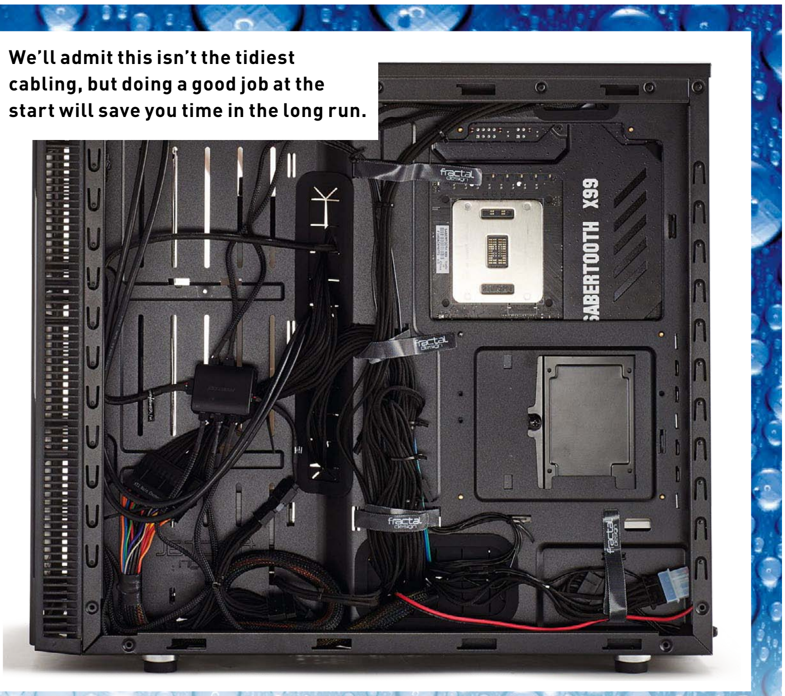
There isn't a fantastic array of places where you can buy a lot of these components in old Blighty. But one of the largest water-cooling specialists in the country is Overclockers UK (www.overclockers.co.uk), which has a vast selection to choose from. Additionally, if you're a little more patient and want to ensure you're getting EKWB directly from the source, you can buy them straight from EKWB's site (www.ekwb.com). Both of these companies were instrumental in providing us with the hardware to bring this first look to you all.

PLANNING YOUR LOOP

So, at this point, you should be well aware of all the hardware you'll need to be looking at. Next, you want to research which case is best. There's a huge variety out there. In fact, you'll find there'll be water-cooling cases from Mini-ITX chassis all the way up to full E-ATX super towers. Once you've found your case, check what radiators it can support for water cooling. Then you need to think about your tubing and how you're going to cool it – a single loop or dual loops. Once you have all these facts nailed down, your best bet is to sketch out how you want to run your loop, and how many fittings you'll need for all your hardware. Usually, you'll need two fittings per water cooling item – an in and an out.



Once you've installed your base components, you'll have a better idea as to how to run your cooling loops.



We'll admit this isn't the tidiest cabling, but doing a good job at the start will save you time in the long run.

For us, the choice was pretty simple. We'd use the Fractal Define S, a case designed from the ground up for easy water-cooling installation. A dual radiator at the top and a triple rad at the front. On top of this, we'd be using a single closed loop to cool both of the EVGA Superclocked GTX 980 Ti's and the Intel Core i7-5820K. Then it was a matter of tallying up how many fittings we needed, taking into account we'd be using soft tubing and a pump/res combo, as well as planning how our build would look. We'd be using an Asus X99 Sabertooth TUF mobo – stunningly gorgeous and covered in black and grey-plated armour. On top of this, we managed to get a hold of a mixture of black water blocks and fittings. We'd use white coolant to add a little contrast.

CHOOSING THE CHASSIS

Picking the right case can be a tricky business, especially when you're looking to do a water-cooled mod such as this. The best way to do this is to look out for cases designed particularly for water cooling, or by companies who revolve around it. Parvum, Phanteks, Corsair, Caselabs and Fractal are all fantastic case firms that provide some excellent rigs to work and build in, making it easy to create a stunning work of art.

Selecting the right case is undoubtedly the biggest consideration you have to make. It will dictate where your reservoir goes, how many radiators fit and what thickness they are, plus how your tubing runs will work. For instance, we tried to build this particular setup inside of the Phanteks Enthoo Evolv, but we'd already pre-ordered the water-cooling components for a different chassis and they ended up being incompatible with the Phanteks, even though that's a huge case to work in.

> "If you're looking for more flare, invest in angled fittings."

FITTINGS AND LOOPS

And so begins the building process. Of course, like with our regular builds, we generally advise that you build all your PCs outside of the case first, just to see if they work at stock. We individually tested both our GPUs, the memory and the CPU with traditional coolers, before throwing water blocks on any of it.

Then we began the internal build process, stripping the chassis of any unwanted components, such as hard drive bays and cages, and continued to install the motherboard, the memory and the GPUs, securing them firmly to ensure that nothing would fall out or become damaged over the course of our build. We also took this opportunity to install the radiators and plug in the fans where they were necessary. It's also time to attach the reservoir, and install all of the fittings.

CABLE MANAGEMENT

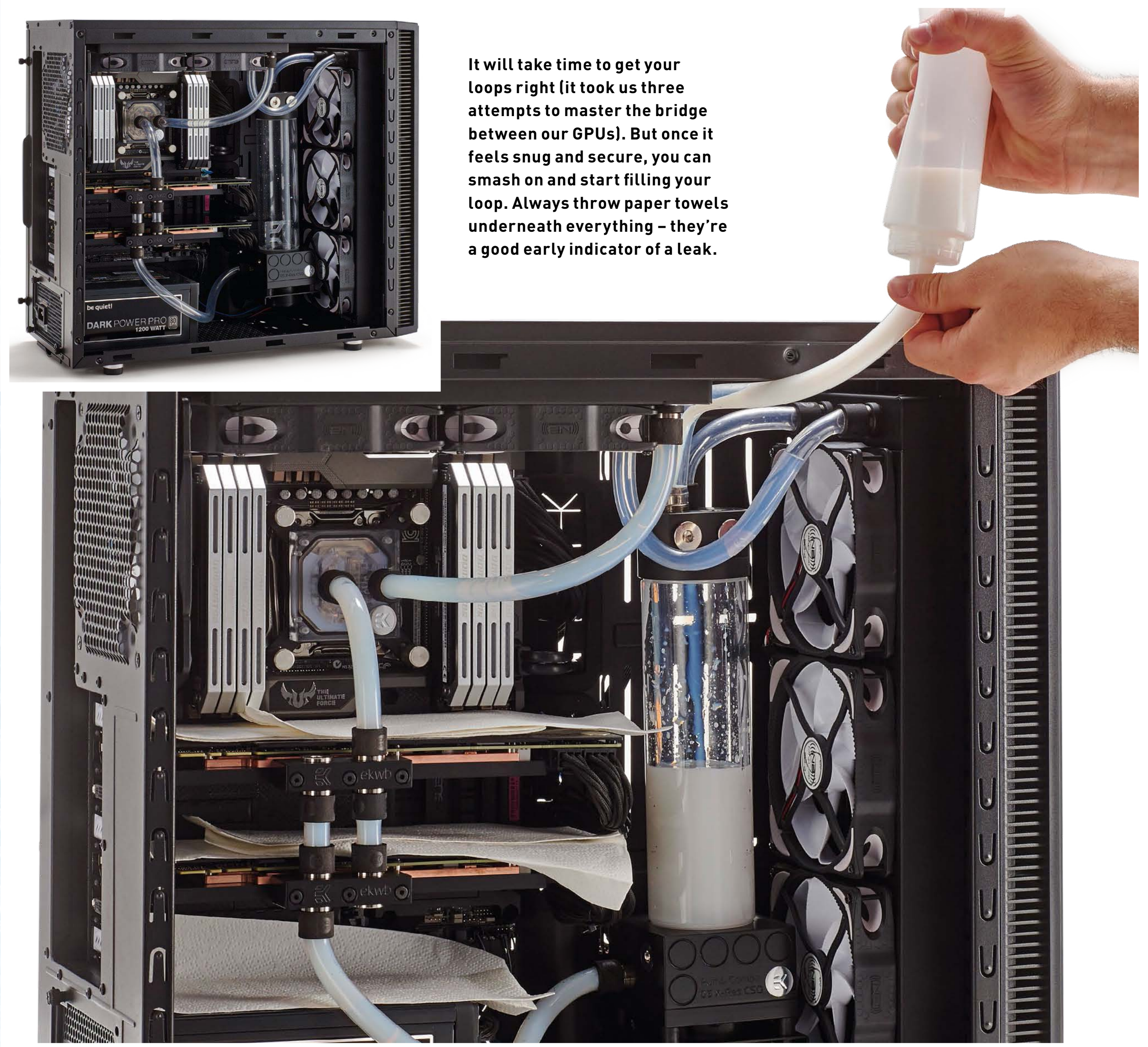
In a build like this, cable management needs to be flawless. The last thing you want is excess, untidy cables cluttering up your rig. Not only will they get in the way of the tubing, they'll also restrict airflow and generally make your tubing routes that little bit more difficult. Cablemod (www.cablemod.com) provides custom-sleeved cables for Be Quiet!, Cooler Master, Corsair, EVGA and Seasonic power supplies. These should spruce up your build quite nicely. Alternatively, it's not impossible to sleeve the cables yourself. This takes a lot more time and patience, but you can include cable combs to keep the cables tidy, plus vary your colour schemes.

Additionally, we used the Phanteks PWM Fan Hub. Threading all five Noiseblocker fans through one fan controller means we can control how much power they receive directly from the CPU fan header, meaning the system will ramp up or down, dependent on CPU temperature (which admittedly will be quite low for this build).

BUILDING AND PRIMING THE LOOP

At this point, it's time to start your tubing runs. Line up a stretch of tubing between the two points you wish to connect, then cut a little more off than you think you'll need. It's better to have too much than too little – you can always shorten the runs later. Next, unscrew one of the fittings, wiggle your tubing onto the fitting and thread the other end of the compression fitting onto the unattached end. Then screw it down, compressing the tubing in place.

If you're struggling to fit the tubing on, use a pair of needle-nose pliers. Gently insert them into the end of the tubing and carefully



It will take time to get your loops right (it took us three attempts to master the bridge between our GPUs). But once it feels snug and secure, you can smash on and start filling your loop. Always throw paper towels underneath everything – they're a good early indicator of a leak.

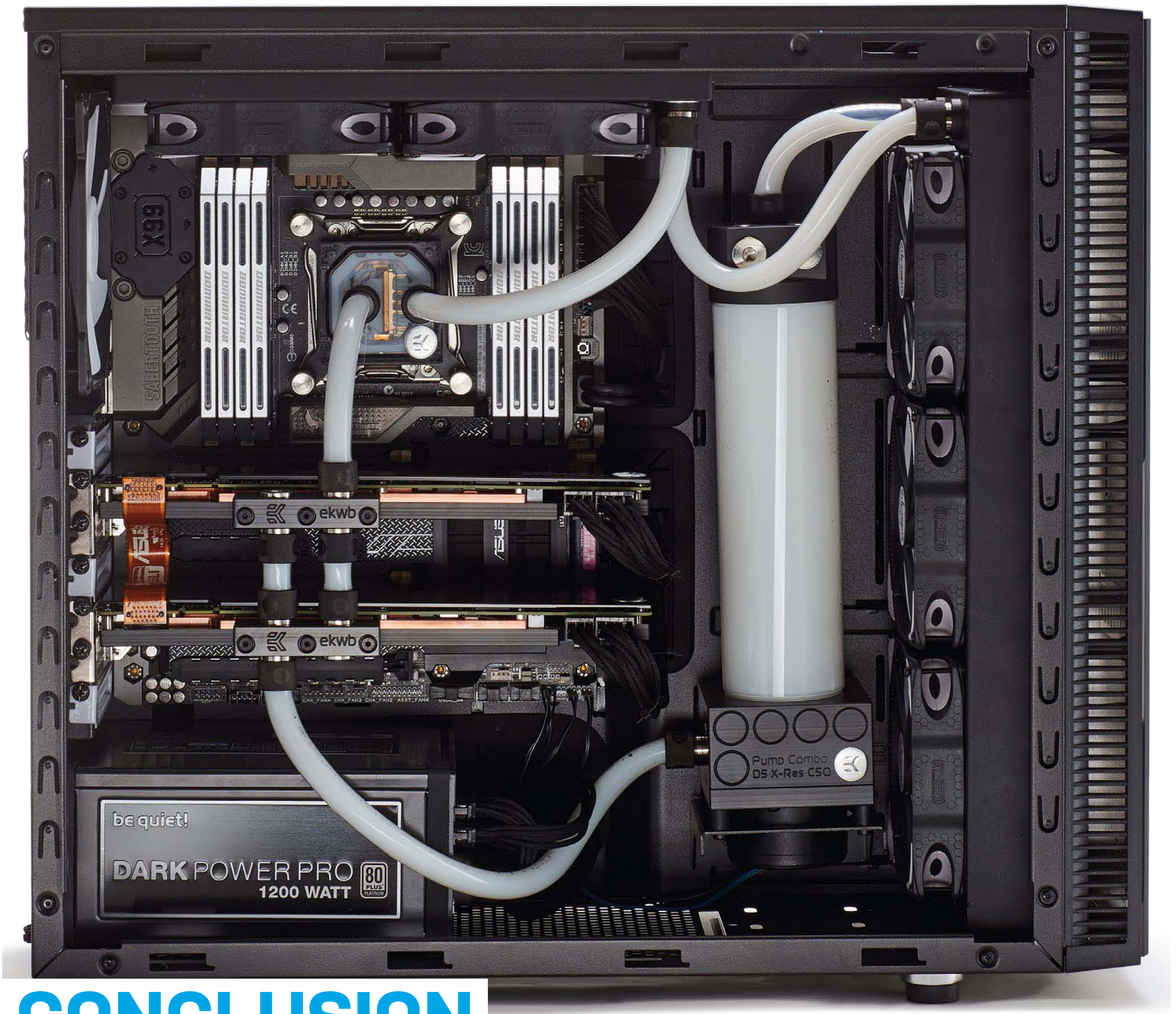
stretch the tubing slightly, so it's easier to work. Then you'll need to take the sleeve off the other fitting, pre-attach that to your new tube and do the same with the other end. It's then simply a case of running all of the tubes to their correct lines. It doesn't matter which tube goes where, as long as it creates a loop. Once the system is sealed off and pressurised, the temperature of the water will be consistent around the entirety of the loop, regardless of which component goes to which first. Thanks science!

You're now at the scary part – priming your loop. Ensuring that the reservoir is gravity feeding the pump (in other words, it's above), attach one last fitting with a length of tubing onto the top of the reservoir (depending on how you have your reservoir set up, it might be advisable to get a multi-port top adaptor). Then use a funnel to carefully pour your coolant into the loop. In our case, we like to just use a squirty plastic sauce bottle to fill our loop.

Before doing any of this, you want to make sure that everything on your motherboard is unpowered. Ensure that your CPU power, your motherboard ATX power and any power cables heading to your graphics card are all unplugged, either at the power supply end or the hardware's end. Then you'll want to either bridge the two power points on the ATX power with a paper clip, or use a specially designed bridge connector. Then it's simply a case of switching the power on every time you fill the reservoir, until the entire loop is filled. Just remember not to do this until after your reservoir/pump has fluid inside of it.

SPECIFICATIONS

CPU	Intel Core i7-5820K @ 4.4GHz
Motherboard	Asus Sabertooth X99
Memory	64GB Corsair Dominator Platinum (8x 8GB) @ 2,666MHz
Graphics	2x EVGA GeForce GTX 980 Ti Superclocked ACX 2.0+
Storage	2x Samsung 850 Evo 500GB SSD
Case	Fractal Define S
Power supply	Be Quiet Dark Power Pro 11 1,200W – Platinum
Fans	5x Noise Blocker NB-eloop B12-2 120mm fans



CONCLUSION

As you've probably already spotted, the build looks great. Matching the black EK water blocks with the Asus X99 TUF Sabertooth worked out really well, and the white provides a brilliant contrast to the overall style and look.

The temperatures are where we expected them to be. We clocked the Core i7-5820K up to 4.4GHz and recorded temperatures at 55 degrees Celsius under load. The GPUs remained at around 60 degrees under full load and we maintained the fans at a constant 20 per cent speed throughout the system. For performance, we couldn't really get much more out of either the GPUs or the CPU as they were already at their hardware limits. But either way, the performance was still outstanding, and the fact that it remained so quiet even while under high load is really something else.

A worthy mention here is definitely the coolant. We used EK White Pastel coolant to fill our loop and it looks fantastic, even with a soft tubing loop. Our leak test went without a hitch. Although we could only test it for around 45 minutes during the shoot, there was absolutely no spillage. The EK compression fittings ensured an incredibly tight seal around all of the components. That is, as long as you haven't damaged the tubing in the process (especially if you're lazy like us and use scissors). Generally speaking, you should always run a leak test for 24 hours minimum before powering any of the components on, but in our case, we simply didn't have time.

In hindsight, we'd have loved to have gone with hard tubing. It's all the rage at the moment, and rightly so – it's some of the nicest-looking water-cooled work you can do. A larger case would have also been good. One of Caselabs's Magnum SM8s or Parvum's ATX chassis would've been fab – going up to two 360mm radiators instead of just the one and a dual radiator would have been great for additional cooling.

A different chip would have also been nice, just to see if we could push beyond the silicon limits on ours. Thermally, there's no issue with our 5820K, it just won't clock beyond 4.4GHz, but that could have been a different story if we'd gone beyond the 4.7GHz boundary. Additionally, running two loops would've looked stunning. One in black and one in white, separating the GPU and the CPU.

Should *you* be water cooling, though? That was the original question. It depends on your budget. As with any build, hard cash is ultimately what it always comes down to. If you're looking for the best bang for your buck, water cooling with a custom loop just isn't for you. Even if you do it on the relative cheap, you'll still be looking at somewhere around the region of £400, minimum, on top of everything else.

Water cooling is for those looking to build a beautiful and quiet workstation capable of destroying benchmarks and running any task you can throw at it with absolute silent ease. It's not for the faint hearted, and although water cooling has come a long way since the first attempts way back yonder, it's still filled with danger and possible hardware failure. But then, we don't know of any aspect of the PC enthusiast's arsenal that isn't. ■

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GAMING

BECAUSE GAMING IS A WAY OF LIFE

What Are You Playing At?

A (screen) shot to the heart

> "You're no longer just the consumer, the end participant in the game."

I USED TO BE LIKE YOU. I used to play a game as it was intended. Here's your start point. Here's your objective. Meet those goals and you'll get a prize. Oooh look, collectibles to, well... *collect.* It was a simpler life, funnelled down the narrow and slightly less linear paths of game design.

Then I discovered the world of tactical screenshotting and free roam video-editing – and, just like that, I ascended to a higher plane and started searching for that mystical and elusive 'perfect shot'. It's become an addiction that's transcended almost every game I've played and it's in danger of taking over my entire gaming life.

I'm not the only one. Just take a look through some of the most popular threads on NeoGAF or Reddit and you'll see the 'cult of the shot' isn't isolated to this burly writer. It's slowly morphing into a sub-art form in itself, with sites such as Dead End Thrills (www.deadendthrills.com) and Other Places (www.otherplaces.co.uk) stripping away the distracting ephemera that make up modern HUDs and crafting something that's not only beautiful, but a celebration of the work of game designers and programmers.

Screenshotting is nothing new, but its increasing popularity is all part of this new-fangled sharing lark – and it's all hinged on a gratification that comes from capturing the right shot with the best lighting and filters, or editing together the best short films, the camera sweeping across beautiful panoramas. It's an addictive way of re-approaching the hobby you already loved (much like getting the streaming bug). You're no longer just the consumer, the end participant in the life-cycle of a game. Now you're the photographer or the director, re-molding a game into something more than trophies.

Of course, it's no surprise that some of the biggest games out there are sporting bespoke photo modes and video-editing suites that give those with the urge and the eye the same options as those that love to mod. From capturing a swathe of viscera that's almost artistic in its trajectory in *Middle-earth: Shadow of Mordor,* to creating mini-movies that could give most pro directors the fear in *Grand Theft Auto V,* simply *playing* a game has become so blasé.

–DOM RESEIGH-LINCOLN

THE 20 BEST FREE GAMES PG. 66

HIGHLIGHTS...

72
Dirt Rally

74
Satellite Reign

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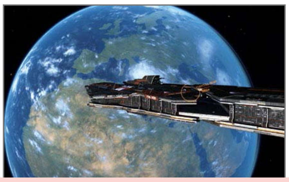
Armello

RECOMMENDED...

THE WITCHER 3: WILD HUNT
CD Projekt RED
Once you're hooked on this giant, gorgeous open world, there's no turning back. **PCF307 p72**

GRAND THEFT AUTO V
Rockstar
A sublime Los Santos sandbox, fleshed-out characters and seriously bling graphics. It's the best *GTA* yet. **PCF305 p72**

PILLARS OF ETERNITY
Obsidian Entertainment
A perfect recreation of the *Baldur's Gate* era, it's an RPG that's huge in scope, full of complexity and rich in imagination. **PCF305 p74**



ELITE: DANGEROUS
Frontier Developments
Carve out your own unique experiences in a game that boasts everything that made the original such a classic. **PCF301 p70**

THE 20 BEST FREE GAMES

Right now, on PC, at least...

BY DANIEL GRILIOPOULOS

There are those who say that nothing in life is really free. Thankfully, they're metaphorists not economists, and they're talking about resources other than money. Some things, in terms of money at least, really are free – even if in terms of time, they're horribly, horribly expensive. Yes, we're talking about free-to-play (F2P) games.

Plenty of F2P games fall into the camp of huge time sinks, where players can get a second-rate experience very slowly, or pay extra to get a first-rate experience with less time. Time is the killer here, so we've selected our favourite F2P games that you'll never need to pay for. (Unless you want to thank the heroic developers who make these things with no guarantee of any reward.)

The games on the next few pages are as good as any paid game, though it's a lot harder to give them away for Christmas. We've tried to pick out a wide selection, so there's something for everyone – from *The Cat and the Coup*, for the political amongst you, to *Dota 2*, for those of who you don't like to sleep.

It's worth saying that we've had to leave out an awful lot of great games. Most sad was the amount of indie games we've not been able to cover. Sites such as Warpdoor (www.warpdoor.com) and IndieGames (www.indiegames.com) are your best bet to find these on a daily basis.

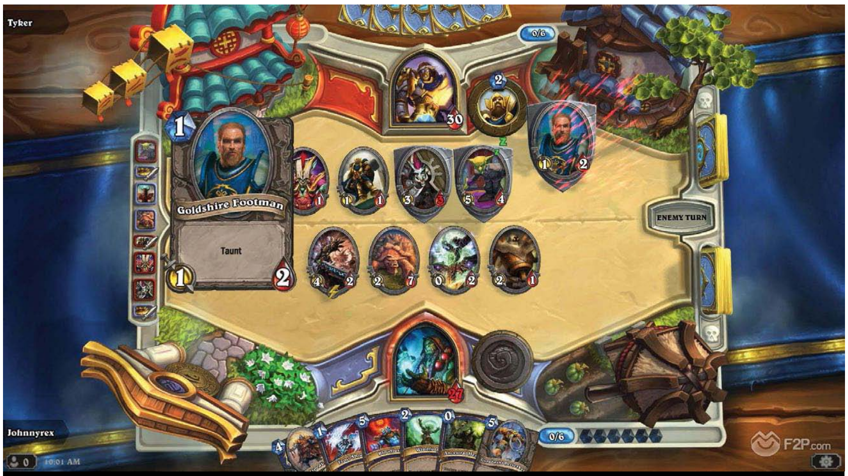
And to mention just a few others... *Double Hitler*, *Star Wars: The Old Republic*, *The Battle of Wesnoth*, *War Thunder*, *League of Legends*, *World of Guns*, *Flow*, *Humanoid 47*, *Kingdom of Loathing*, *A Dark Room*, *Fallen London*, *Where is My Beard*, *No One Has to Die*, *Neverwinter*, *Smite*, *Hawken*, *Wolfenstein 3D*, *Tyrian*, *Realm of the Mad God*...

Dota 2

There's no denying the popularity of Valve's team arena game. At the time of writing, 16 teams are competing for a prize pot of over $18 million, with much of that money coming from the game's community. The game itself has you taking control of one unique character alongside four others, playing against another team of five in a RTS map. You need to level up and take down the enemy's towers and fortress, while preventing them destroying yours. Very impressive for a game that started as a simple mod to *Warcraft III*.
http://blog.dota2.com

Heroes of the Storm

It seems mad to have two multiplayer online battle arenas, or MOBAs, in here. Particularly two MOBAs that are so similar. And especially mad to leave out *League of Legends*, considering it's even bigger than *Dota*. But *LoL* is older than *Dota*, and features almost identical gameplay to an outsider. By comparison, *Heroes of the Storm* is much more casual and accessible; not unexpected given that it's come from Blizzard itself. Players take control of a hero from the *Starcraft*, *Warcraft* and *Diablo* universes, with a much larger variety of maps compared to *DOTA* and *LoL*.
http://eu.battle.net/heroes/en/



Hearthstone

Another Blizzard title, this game signifies a huge change in the *World of Warcraft* dev's style. Instead of creating huge games that cost the GDP of a small country to rake in tons of money… it's doing the same thing, but with free games. *Hearthstone* is a Collectible Card Game, in which you pay or play to unlock cards, building decks for competitive play, or for use against the AI in one-off battles or story campaigns. It's highly skilful, but also rewards casual players.

http://bit.ly/1F2zqJn

World of Tanks

Developer Wargaming.net now employs several thousand people across 16 countries, as well as owning much of Cyprus, and it's all down to the surprising success of *World of Tanks* (and its sister titles *World of Warplanes* and the forthcoming *World of Warships*). *WoT* is the one that's paid for all those staff though, and that's because it's like a very slow FPS. Players take control of a range of historical tanks in PvP battles – from heavy monsters like the Tiger II, to tank hunters and artillery – and attempt to either destroy the other team or capture bases.

http://worldoftanks.com

WARGAMING.NET

Trackmania Nations Forever

Few game developers know how to bottle joy. It takes a combination of special things – bright, clear art, simple mechanics and endless replayability. *Super Mario Sunshine* has it, and so does the PC-only stunt-racer *Trackmania*. It also lets you create your own tracks, try them out, share them and challenge your friends. *Forever* isn't the newest version of *Trackmania*, but it combines the best earlier versions of the game – *Trackmania Original*, *Sunrise* and *Nations* – which means it has huge amounts of content.

http://trackmaniaforever.com

Free-to-play MMOs, such as *Neverwinter*, are now the norm.

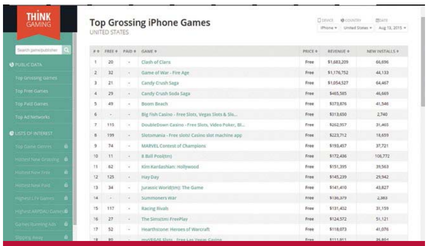
The Death of MMOs

THE FREE GAMES revolution opened up all sorts of genres that seemed stagnant or vanished – puzzle adventure games have been revived by the hidden object game, and platformers by the flash platform – but it's slowly spelled the death knell for paid-for massively multiplayer online games, or MMOs.

"Free-to-play, it's the better business model," Mike Donatelli told us. He's from Carbine Studios, creator of *Wildstar*. "Fact. There are no barriers to entry. Pick a forum, any forum, go there and there'll be people saying, 'I like the game, I'm just not paying you any money for it.' And that's *every* post… we absolutely acknowledge that the MMO community has evolved past the (subscription) business model."

It's also interesting that investing huge sums of money into creating these MMOs seems less attractive, as revealed by Blizzard's Mike Morhaime, when the dev's *World of Warcraft* follow-up *Titan* was recently cancelled. "We didn't find the fun," he said. "We didn't find the passion. We talked about how we put it through a reevaluation period, and actually, what we reevaluated is whether that's the game we really wanted to be making. The answer is no." The games that it seems to want to be making are *Hearthstone* and *Heroes of the Storm* – both free, small, multiplayer, skill-based games with strictly limited ambition. So *Titan* was turned into a small, skill-based multiplayer shooter called *Overwatch*.

Of those MMOs that were subscription-based, such as *Wildstar*, very few are still so. *Star Wars: The Old Republic*, *Rift*, *Dungeons & Dragons Online*, *Neverwinter*, *Star Trek Online*, *The Elder Scrolls Online*… they've all changed their stripes, cancelling the subscription charges and quite often the up-front purchase cost as well, instead charging for in-game fripperies.



Top Grossing iPhone Games
UNITED STATES

#	FREE	PAID	GAME	PRICE	REVENUE	NEW INSTALLS
1	20	-	Clash of Clans	Free	$1,683,209	66,696
2	32	-	Game of War - Fire Age	Free	$1,176,752	44,133
3	21	-	Candy Crush Saga	Free	$1,054,527	64,467
4	29	-	Candy Crush Soda Saga	Free	$465,585	46,669
5	49	-	Boom Beach	Free	$373,876	41,546
6	-	-	Big Fish Casino - Free Slots, Vegas Slots & Slo...	Free	$313,650	2,740
7	115	-	DoubleDown Casino - Free Slots, Video Poker, Bl...	Free	$262,957	31,465
8	199	-	Slotomania - Free slots! Casino slot machine app	Free	$223,712	18,659
9	74	-	MARVEL Contest of Champions	Free	$193,457	37,721
10	11	-	8 Ball Pool(tm)	Free	$172,436	106,772
11	62	-	Kim Kardashian: Hollywood	Free	$151,395	39,563
12	125	-	Hay Day	Free	$145,239	29,942
13	34	-	Jurassic World(tm): The Game	Free	$141,410	43,827
14	-	-	Summoners War	Free	$136,379	2,383
15	117	-	Racing Rivals	Free	$131,402	31,159
16	27	-	The Sims(tm) FreePlay	Free	$124,572	51,121
17	52	-	Hearthstone: Heroes of Warcraft	Free	$118,073	41,076

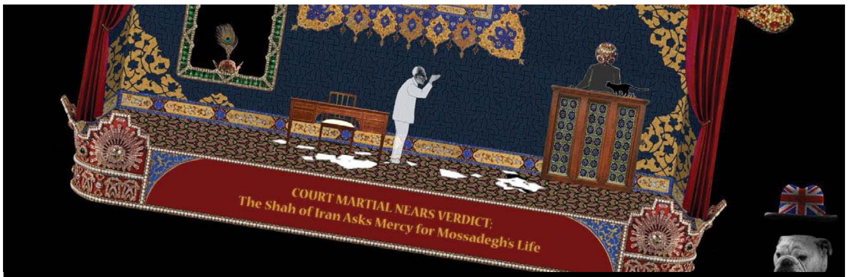
Lessons from Mobile Gaming

FREE GAMING MAY have started on PC with freeware titles like *Wolfenstein 3D*, but mobile games are its home. Take a squint at that image above – that's the top 50 highest grossing games on iOS on a particular day in August this year. The highest ranked paid-for game was *Minecraft: Pocket Edition* ($6.99) at number 24, followed by the creepy *Five Nights at Freddy's* at 39. Apart from that, every other game was free and making huge amounts of money. *Clash of Clans*, already out for years, made $1.6 million in a week, in just the US.

This is partly a result of the ease of microtransactions on mobile devices. Players can buy an in-game item for a miniscule sum of money without leaving the app or hunting down their credit card information – indeed, on the newer iPhones, it's just a tap of your thumbprint and you've spent the money.

It's partly because the developers making games on these platforms are obsessed with money. These aren't hipster indies keen to demonstrate their credentials and make a critical success. If you attend one of the mobile game conferences, such as Pocketgamer Presents or Mobile World Congress, the talk is all about monetisation, and has been for years. How to make money more efficiently? How to buy customers and good reviews? How to game the various in-game advertising systems? How to artificially bump yourself up the charts and get Apple's attention? Every year, Apple bans another method of making money from mobile games, like some financial regulator dealing with dodgy banks.

But it's mostly the result of market saturation. There are so many games released every day – so many good ones and so many knock-offs – that the effect has been to push the price to zero. Why buy *Angry Birds* for £1.99 when you can get the functionally identical *Ornery Avians* for free? It's a constant worry of PC game developers that the price of all games will be driven down to zero. Thankfully, the PC market still seems happy to pay console prices for games at launch, perhaps because of the cost of buying or building your own gaming PC.

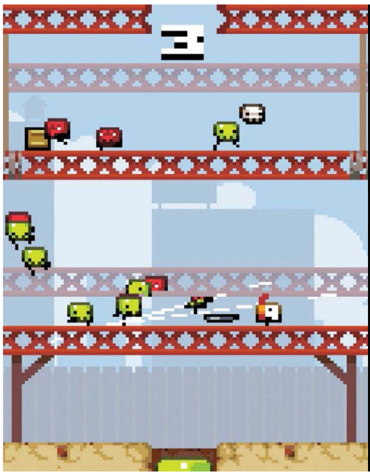

COURT MARTIAL NEARS VERDICT:
The Shah of Iran Asks Mercy for Mossadegh's Life

The Cat and the Coup

There are many free indie games, but few with a message as moral as *The Cat and the Coup*. Players control the president of Iran's cat during the CIA / MI6-engineered coup that brought down the democratically elected government, and led eventually to the current Islamic state. You use the cat to solve puzzles and move the president. It's as much interactive art and history lesson as it is a game.
www.thecatandthecoup.com

Team Fortress 2

Though *Team Fortress 2* has fallen out of favour in recent years, it was the game that revolutionised free-to-play gaming. Players compete in two teams of cartoon movie caricatures – from the minigun-toting Heavy to the Germanic-accented Medic – battling over objectives such as capturing bases or simply killing as many of each other as possible. A range of game mode additions, AI bots, custom maps and a huge range of weapons – both randomly dropped and bought – have given the game a huge amount of replayability.
www.teamfortress.com

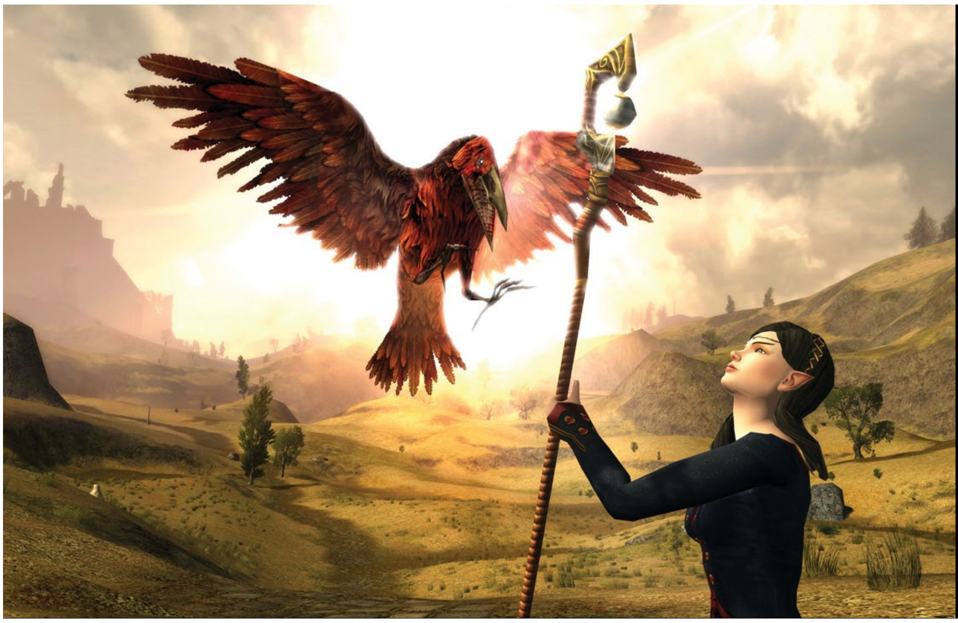


Super Crate Box

Vlambeer is the current darling of indie development, with its co-founder Rami Ismail acting as a strong voice of toleration and creativity for developers everywhere. *Super Crate Box* is a retro single-screen game, resembling the original Game and Watch Nintendo machines, where enemies fall from the top of the screen and crates full of weapons spawn randomly. You must survive for as long as possible while killing enemies using the random weapons. If you like this, try Vlambeer's other games, such as *Luftrausers* or *Nuclear Throne*.
http://bit.ly/1I7MVad

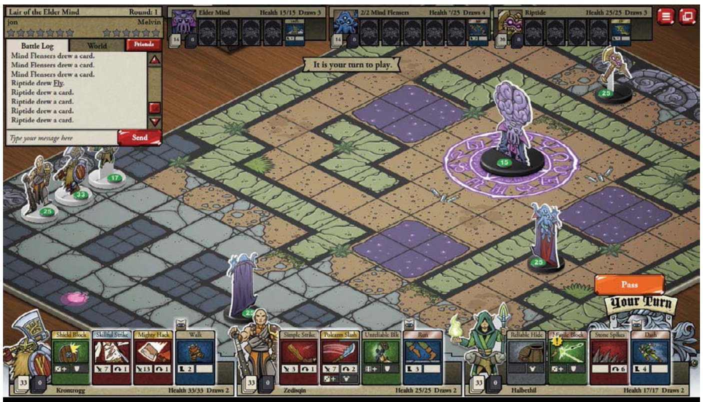
Path of Exile

Though *Diablo 2* is widely acknowledged as the king of the action RPG genre, and *Diablo 3* is the prettiest example of the genre (save for maybe *Torchlight 2*), these are paid-for games. By contrast, *Path of Exile* is neither particularly beautiful, not as crunchy as *Diablo 2*, but it is free and extremely well-made and compelling. It's the kind of game where you kill thousands of enemies in your lust for loot – and maybe to move the story on. It has a range of game modes (called 'leagues') which change regularly. Oh, and it has the world's most ridiculous skill tree.
www.pathofexile.com



Lord of the Rings Online

Rift may be much shinier, and *Dungeons & Dragons: Online* might be more familiar to most gamers, but the now-aged *LOTRO* will always have a special place in our hearts. Players take control of an innocent, whose plot tracks alongside the plot of the *Lord of the Rings* books, supporting the Fellowship quietly. With beautiful recreations of the Shire, Rivendell, Moria and Weathertop, it genuinely feels like Middle Earth. On the flip side, you can also play as a max-level monster in PvP against other humans. We just hope they can keep the game going to complete the story.
www.lotro.com


Lair of the Elder Mind
Round: 1
jon
Melvin
Battle Log
World
Friends
Elder Mind
Health 15/15 Draws 3
2/2 Mind Flensers
Riptide
Health 25/25 Draws 3
It is your turn to play.
Type your message here
Send
Pass
Your Turn
Kromrogg
Health 33/33 Draws 2
Zedaqin
Health 25/25 Draws 2
Halbethil
Health 17/17 Draws 2

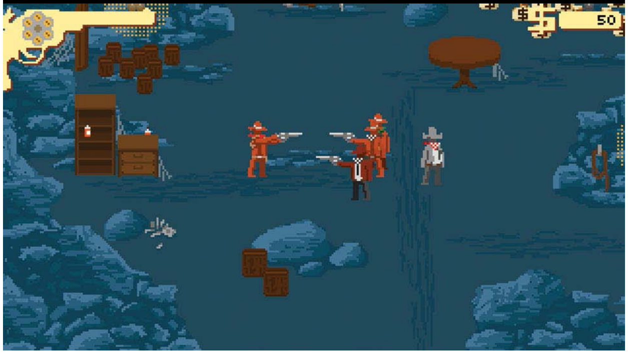
Mind Flensers drew a card.
Mind Flensers drew a card.
Mind Flensers drew a card.
Riptide drew Fly.
Riptide drew a card.
Riptide drew a card.
Riptide drew a card.
Riptide drew a card.

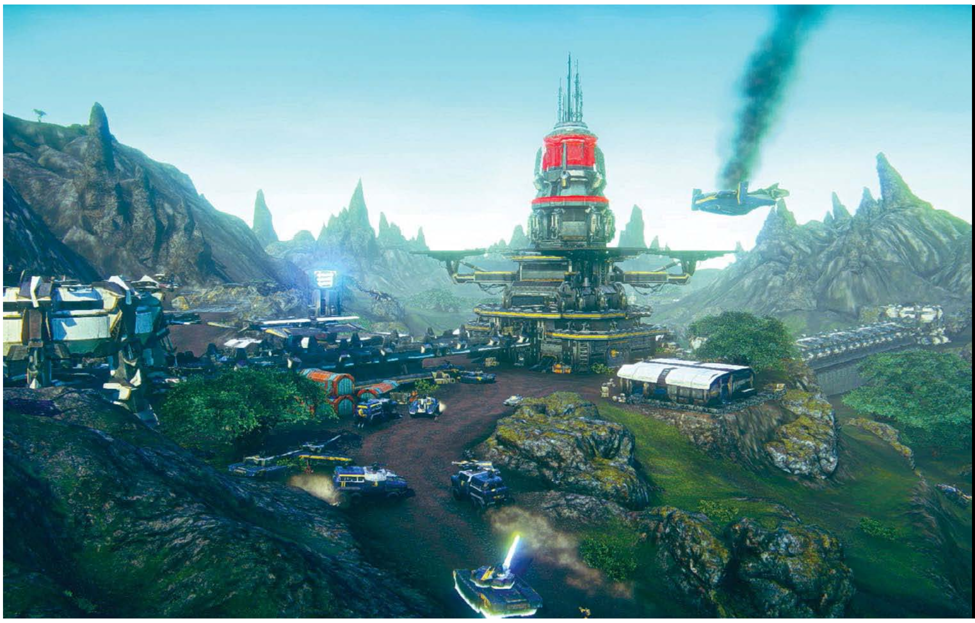
Card Hunter

One of the smartest games around, *Card Hunter* is a mix of *D&D* and *Magic: The Gathering*. You take the role of a team of geeks playing an RPG against their novice dungeon master. You have three characters, each with a deck of cards determined by their class, race and equipment. With a neat plot following the fictional roleplay session, as well as a separate story in-game, there's also a PvP mode. The recent expansion added science-fiction tropes.
http://bit.ly/1MOl7zt

Westerado

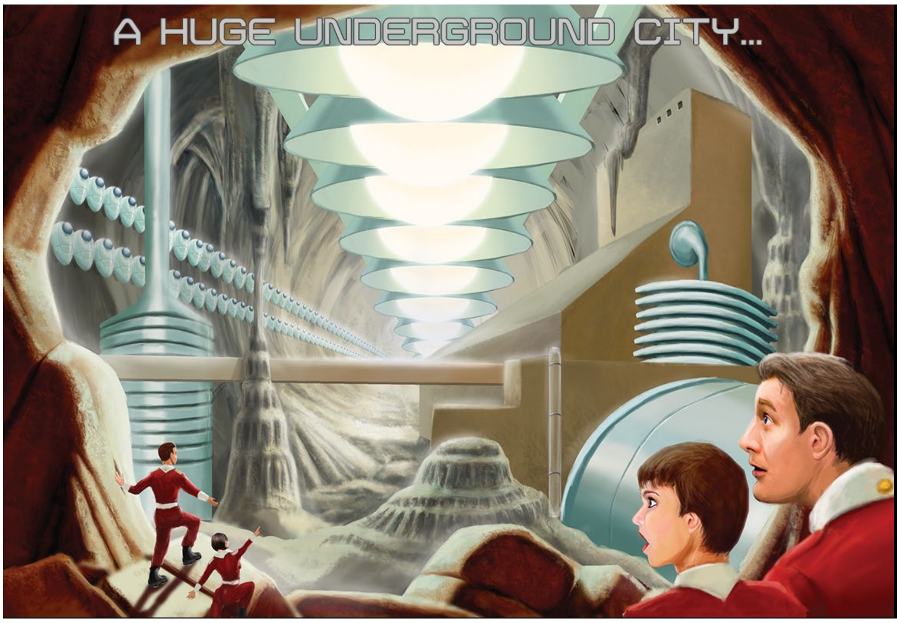
The West was a hard place, full of hard men, hard women and hard horses. Men with identikit faces who you try to recognise from wanted posters. Men whose hats you can shoot off. Men who can pull a gun at any point during a conversation, just to make a point. *Westerado* is half-*Zelda* world exploration game and half slapstick-gritty tale of cowboy revenge, incredibly stylish and totally free. If you want to support the developers, a paid-for version of the game with slightly more content is available on Steam.
http://bit.ly/1dVw25e





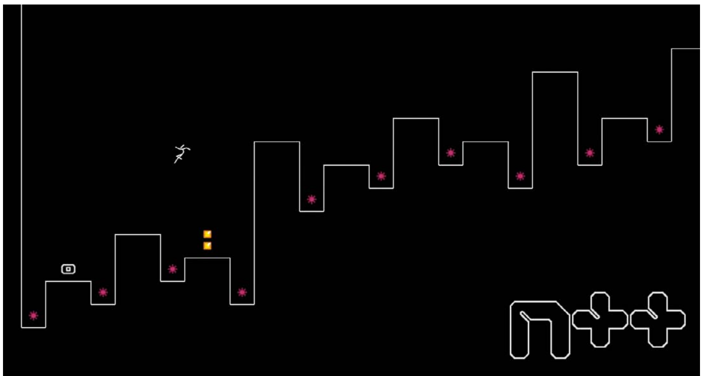
Planetside 2

Team Fortress 2 might have the best small team combat in the world, but if you want combined arms combat – that is a huge variety of tanks, vehicles, infantry and aircraft – then the *Planetside* series is where you've got to go. Players join one of three factions fighting across several continents on the huge open world of Auraxis. The FPS combat and world layout is smartly done, so players can find themselves in huge battles or playing cat and mouse in empty enemy bases. The only caveat is that levelling to get more equipment takes some time and the real money kit is rather expensive.
www.planetside2.com


A HUGE UNDERGROUND CITY...

The Ur-Quan Masters

Once upon a time (1992) there was a game called *Star Control II*. It was one of those games that did just about everything – a science-fiction game involving the exploration of star systems, hyperspace travel, alien diplomacy and a range of 25 different alien species to 'engage' with. Really, beneath that skin, it was an adventure game, where you pilot the last surviving free spaceship in a bid to free the galaxy from the despotic Ur-Quan, while they're distracted by civil war. The *Ur-Quan Masters* is an open-source 2002 port that brought *Star Control II* to modern operating systems – for which, we're very grateful. This link is to an HD version.
http://urquanmastershd.com

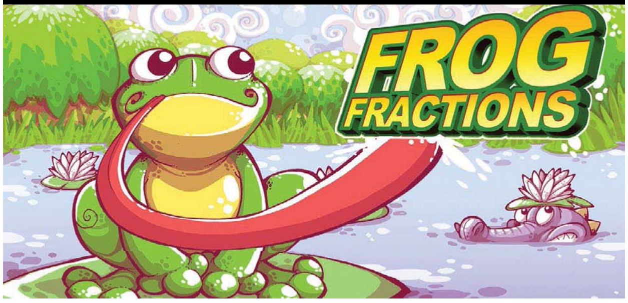


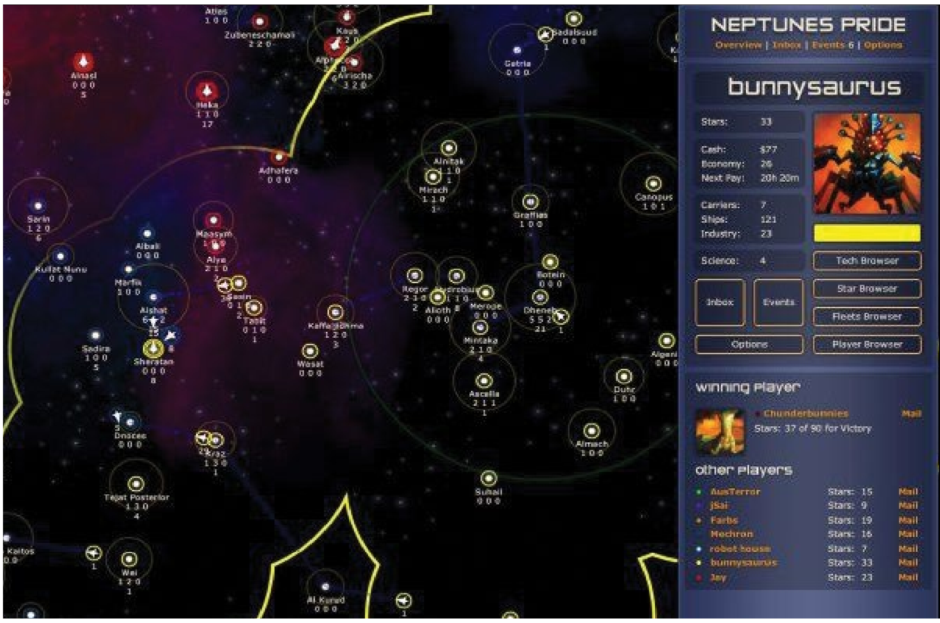
N 2.0

The *N* games have quietly been the inspiration behind many other action-puzzle games, such as the *Meat Boy* games and *Gunpoint*, but have never achieved mainstream success. You control a highly agile and flexible ninja, who uses impetus and physics to make his way through a maze of death. Homing missiles, mines and plain-nasty gravity are all threats as you collect keys and points, and attempt to complete each level in double-quick time. If you like this, you can buy the comprehensive *N++*, which has just come out.
http://bit.ly/1mQIEnc

Frog Fractions

Comedy is rare in games, and more frequently unintentional or emergent than scripted. Except for a few adventure games, and *Frog Fractions*. The game is a strange amalgam of parody and adventure, sometimes feeling like an edutainment game, sometimes like an escapee from Monty Python. It only lasts an hour, but takes you through politics, philosophy, drama, a law court, a strange upgrade tree and much time spent eating insects. (Much like the career of a modern z-list celebrity.) The sequel has been Kickstarted but not released – indeed, the creator has suggested he could release it under a completely different name.
http://twinbeard.com/frog-fractions/





bunnysaurus

Stars: 33
Cash: $77
Economy: 26
Next Pay: 20h 20m
Carriers: 7
Ships: 121
Industry: 23
Science: 4

winning Player

Chunderbunnies Mail
Stars: 37 of 90 for Victory

other Players

AusTerror	Stars: 15	Mail
jSai	Stars: 9	Mail
Farbs	Stars: 19	Mail
Mechron	Stars: 16	Mail
robot house	Stars: 7	Mail
bunnysaurus	Stars: 33	Mail
Jay	Stars: 23	Mail

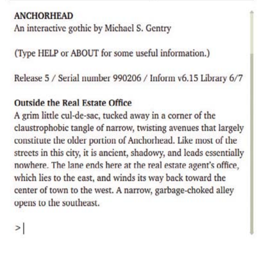
Neptune's Pride 2

How much do you like your friends? *Really* like them? How much would it take to break you apart? If the answer is 'not a lot', then you might want to move on from *Neptune's Pride*. The game, like the board game Diplomacy, is a real-time game of power balances and betrayal set within a galactic space. You gradually build your fleets and your friendships with your neighbours, conducting diplomacy, researching technology, forming alliances, reinforcing your planets and investing in peace... and then you turn on each other in an orgy of destruction. As each game can take several weeks, the betrayals really hurt.
http://np.ironhelmet.com

Samorost 1 & 2

Amanita's delightful browser games (named after the Czech for 'driftwood') are set on a strange, small planet inhabited by a gnome. You control him to avert a collision with a spaceship by solving a series of surreal organic puzzles. Creative character designs, innovative art and a haunting soundtrack made both games a success. Later, the same company made *Machinarium*, generally reckoned the best indie game of 2009. Now it's working on *Samorost 3*.

http://amanita-design.net/games.html



Outside the Real Estate Office   day one

ANCHORHEAD
An interactive gothic by Michael S. Gentry

(Type HELP or ABOUT for some useful information.)

Release 5 / Serial number 990206 / Inform v6.15 Library 6/7

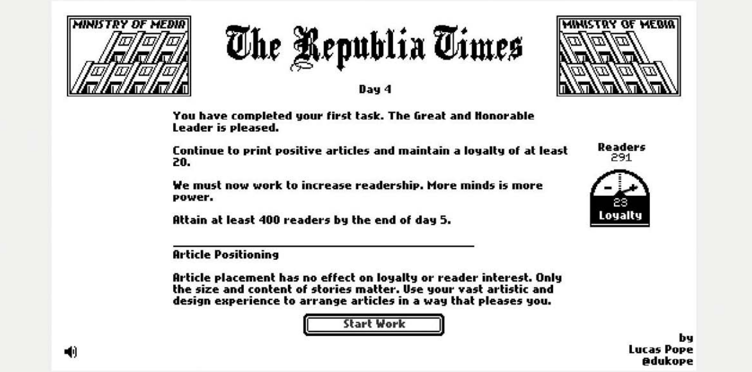
Outside the Real Estate Office
A grim little cul-de-sac, tucked away in a corner of the claustrophobic tangle of narrow, twisting avenues that largely constitute the older portion of Anchorhead. Like most of the streets in this city, it is ancient, shadowy, and leads essentially nowhere. The lane ends here at the real estate agent's office, which lies to the east, and winds its way back toward the center of town to the west. A narrow, garbage-choked alley opens to the southeast.

>|

Anchorhead

There are thousands of excellent text adventures available for free, from the older *Zork* games to Inform and Twine games such as *Horse Masters*, *Slouching Towards Bedlam*, *Violet*, *Galatea*, *80 Days*, *My Father's Long, Long Legs* and many more. Visit www.ifarchive.org to find out more. *Anchorhead* just happens to be one of the best-written and most-accessible interactive fiction games, set in the Cthulhu mythos. You're moving with your husband to a new house and new town, but something very old and nasty is stirring.

http://pr-if.org/play/anchorhead/



You have completed your first task. The Great and Honorable Leader is pleased.

Continue to print positive articles and maintain a loyalty of at least 20.

We must now work to increase readership. More minds is more power.

Attain at least 400 readers by the end of day 5.

Article Positioning

Article placement has no effect on loyalty or reader interest. Only the size and content of stories matter. Use your vast artistic and design experience to arrange articles in a way that pleases you.

The Republia Times

Lucas Pope is better known for creating *Papers Please*, the dystopian border control game, where you have to balance your family's welfare, a totalitarian state's insane laws and the lives of those crossing the border. *The Republia Times* is another small game of his, this time focusing on the role of state media. As the editor of a propaganda newspaper, your job is to keep as many of the people loyal as possible, despite the dreadful things your regime is doing, by emphasising only positive stories.

http://bit.ly/1JuTKYS

The Future of Free

Mark Sorrell, from *Angry Birds* creator Rovio, talks behavioural science and economics

What's the state of play of F2P?

It's fine. That is a rather broad question. F2P is healthy and growing. It's still young and, despite the number of entrants to the genre, there is surprisingly little innovation or new thinking, particularly in the West. But make no mistake, the biggest games on the planet are free to play, and due to the importance of network effects in making F2P economies work, are only strengthening their positions over time.

Is there a type of game where the paid model still makes sense?

This depends very much on how you define 'type of game', but certainly if you have a very clearly defined and enthusiastic user base, who are happy to pay up-front and willing to buy further content inside the game, then it's possible to make great returns with a pay up-front system. The free part of free to play is a marketing stunt. Combining the large user bases free can provide with the variable pricing of an IAP economy is how F2P has become so dominant – barriers to entry are as low as possible and potential upside is as high as possible. So paid models can still make huge money where two things are true. A high enough percentage of their total addressable market must be willing to pay and the game must feature lots of things to buy inside the game.

With expensive hardware-heavy tech, like VR, does F2P still have an advantage, given the consumer-level financial barriers to entry?

No. VR seems likely to remain a novelty for early adopters for a significant time to come, and they are exactly the sort of clearly defined and enthusiastic user base that are easy to market to and willing to pay up-front. They are also likely to be willing to pay a considerable premium for the chance to show-off or experience their new toy at its best. Alongside that, the hardware requirements will shrink the market, which makes the social drivers behind a lot of F2P spending harder to engineer. And then the sessioning the hardware demands (you have to put a big metal hat on) further limits game design. So, where F2P will work, it will be the *League of Legends*/*Hearthstone* kind of design, rather than anything from mobile.

Downforce matters when you're inches from death.

Gold
PCFormat
Gold

Dirt Rally

It'll leave skid marks on more than your screen

THREE YEARS AGO, Codemasters's smooth-running *Dirt* series hit a filthy great pothole, otherwise known as *Dirt: Showdown*. Sure, this wasn't necessarily the greatest disappointment in racing game history – it's up against *Need for Speed: ProStreet* and *Test Drive Unlimited 2* for that honour – but it marked a low point in the series's decline from rally simulator to arcade smash-'em-up. So, just as any film or game franchise still worth a buck inevitably gets a reboot, Codemasters is back to repair the damage.

Dirt Rally is nothing like its predecessor. It harks back to the original *Colin McRae Rally* games that started the series way back in 1998, focusing squarely on realistic rallying with none of the capture-the-flag antics of *Dirt 3*. If you're after that kind of arcade experience, *Rally* won't get your motor running. This is Codemasters gunning for sim status, and the result is far more like a spiritual successor to 2004's uncompromising *Richard Burns Rally*.

What made that game great – as well as early *Colin McRae* titles – was its ability to convey the butt-clenching tension and merciless nature of stage rallying. Threading a 300-plus BHP, turbo-charged missile through twisting loose-surface lanes – often little wider than the car and lined with unforgiving trees and rocks – isn't a sport with second chances. Consequently, *Dirt Rally* ditches the flashback gimmickry you got in earlier instalments. Even restarting is discouraged, with a $5,000 event bonus awarded for completing a rally without a restart. And the unrelenting realism doesn't end there.

WILD RIDES

Slide off course and you've got 10 seconds to get back on track. In that time you can try and scramble your own way out of the weeds, or opt to have your car recovered, with a resulting time penalty added.

Launch yourself so far into the wilderness that virtual helping hands can't reach you and that's it, stage over. Plus, unlike circuit racing where you're never more than a lap away from your pit crew, crashing or even getting a puncture in *Dirt Rally* means you've got no choice but to limp to the end. There's just one 30-minute service session for repairs in a four-stage rally, and while this can be stretched to an hour, the resulting time penalty is only worth incurring if your chariot is closer to death's door than Bill Cosby's career.

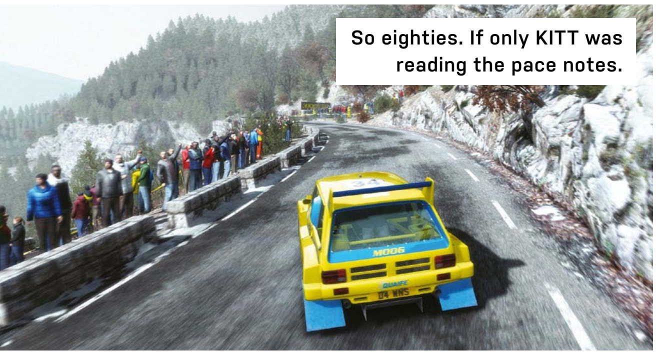
With so many roadside hazards and tough penalties for hitting them, using full throttle at speed in all but the most mundane machines is often just a quicker way to end up balls-deep in a bush. And not in a good way. Then, if you throw out the anchors too aggressively, you'll skid even further into the undergrowth. This may all seem more like motoring masochism, but persevere, listen to your co-driver's pace notes like your life depends on them, and, with a little luck, you'll make it to the finish with a sense of achievement that few racing sims can match. Make no mistake, *Dirt Rally* is tough, but it's exactly this sense of all-or-nothing pressure that also makes it immensely rewarding and addictive.

No rally game is complete without the Ferrari-powered style icon that is the Lancia Stratos, and along with this you're treated to its seventies stablemates, like the Ford Escort Mark II and Fiat 131 Abarth. However, you'll only have enough cash (and probably skill) at the start of your career to pilot an original Mini or Lancia Fulvia, but it doesn't take long to earn enough for something fruitier.

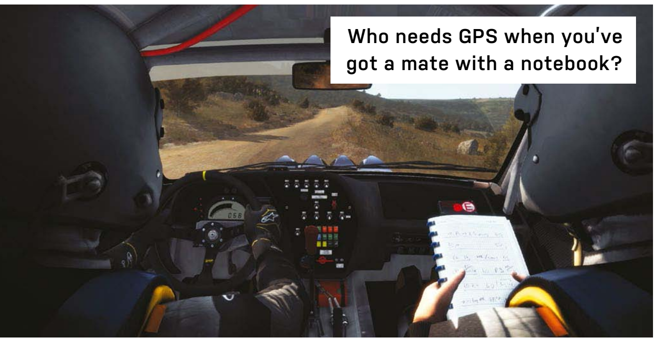
All the most mental Group B rocketships are on offer, plus several rear-wheel drive cars from the period, such as the Lancia 037, Ford Sierra Cosworth and E30 BMW M3. Nineties Group A options aren't quite so well represented, with just the Escort Cosworth, Lancia Delta Integrale and a 1995 Subaru Impreza to choose from. If Codemasters add the legendary Castrol Celica GT-Four and Tommi Mäkinen's Lancer Evo VI, plus more retro metal like the Renault 5 Maxi Turbo and maybe an

Fast and furious, but with better dialogue.

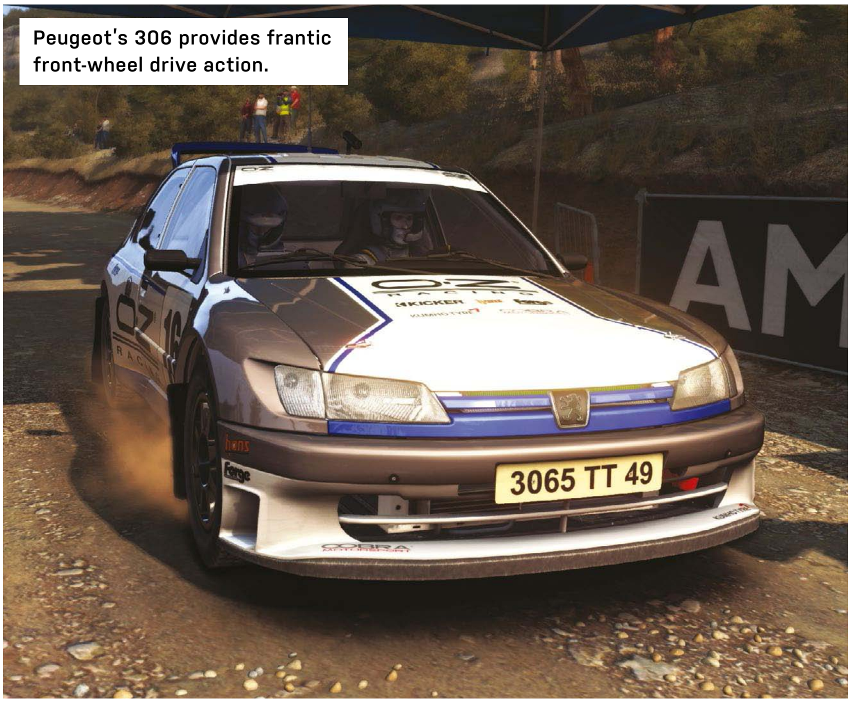
A beautiful summer's day in Wales.



So eighties. If only KITT was reading the pace notes.



Who needs GPS when you've got a mate with a notebook?



Peugeot's 306 provides frantic front-wheel drive action.

Alpine A110, then *Dirt Rally*'s car selection would be sublime.

But it's the rally locations that need addressing first. What's included is well modelled and immersive, but we need quantity as well as quality. You've got Greece for gravel stages, the tarmac and ice of the Monte Carlo rally, Germany's countryside backroads, plus damp and muddy forest tracks in Wales. It's a good variety, but many of the stages are simply reverse runs of others, and even more fun could be had with the addition of Finland's super-fast dirt roads or an all-snow rally like Sweden.

RACE FEVER

If you're after more variety, there's always different disciplines, like rallycross or hill climbing. The latter is restricted to just a single venue, but it is the best: Pikes Peak, with both the classic dirt and the present paved configuration. Three cars are available, and Codemasters hasn't messed about. There's the fearsome Peugeot 205 T16, 405 T16 and Audi S1 Quattro, each in full-on Pikes Peak spec, wearing wings outrageous enough to make a Plymouth Superbird look subtle.

Rallycross currently includes two tracks: one in Sweden, the other England's Lydden Hill. In a break from the eighties Group B theme, your choice of wheels are the bang up-to-date Ford Fiesta, VW Polo and Peugeot 208, packing over 550BHP a piece. Racing is close and aggressive with a minimum of three opponents, plus there's a longer joker lap in every race to spice things up. Missing this will get you a time penalty, as will corner-cutting, and while rubbin's definitely racing, ramming will damage your ride, and as always, repairs don't come easy. It's exhilarating, with the only slight criticism being that there are only four opponent skill settings. Once you've nailed each course, even the Very Hard difficulty isn't quite hard enough.

Of course, as *Dirt Rally* is still Early Access, there's scope for tweaks as well as extra cars and locations. But what you get now is as polished as any fully fledged Codemasters title, with very few glitches. Graphical quality isn't quite on a par with *Project Cars*, but the visuals are easy on the eye and also your rig, with a single GTX 960 able to run most settings maxed out at 2560 x 1440 while maintaining 40-plus fps.

However, what's most impressive is the superb handling, stage design and a car line-up that'll give most gear heads a stiff shifter. *Dirt Rally* may still be a work in progress, but it's already more than just a return to form. It's quite possibly the most accomplished rally sim ever. –**BEN ANDREWS**

VERDICT 9

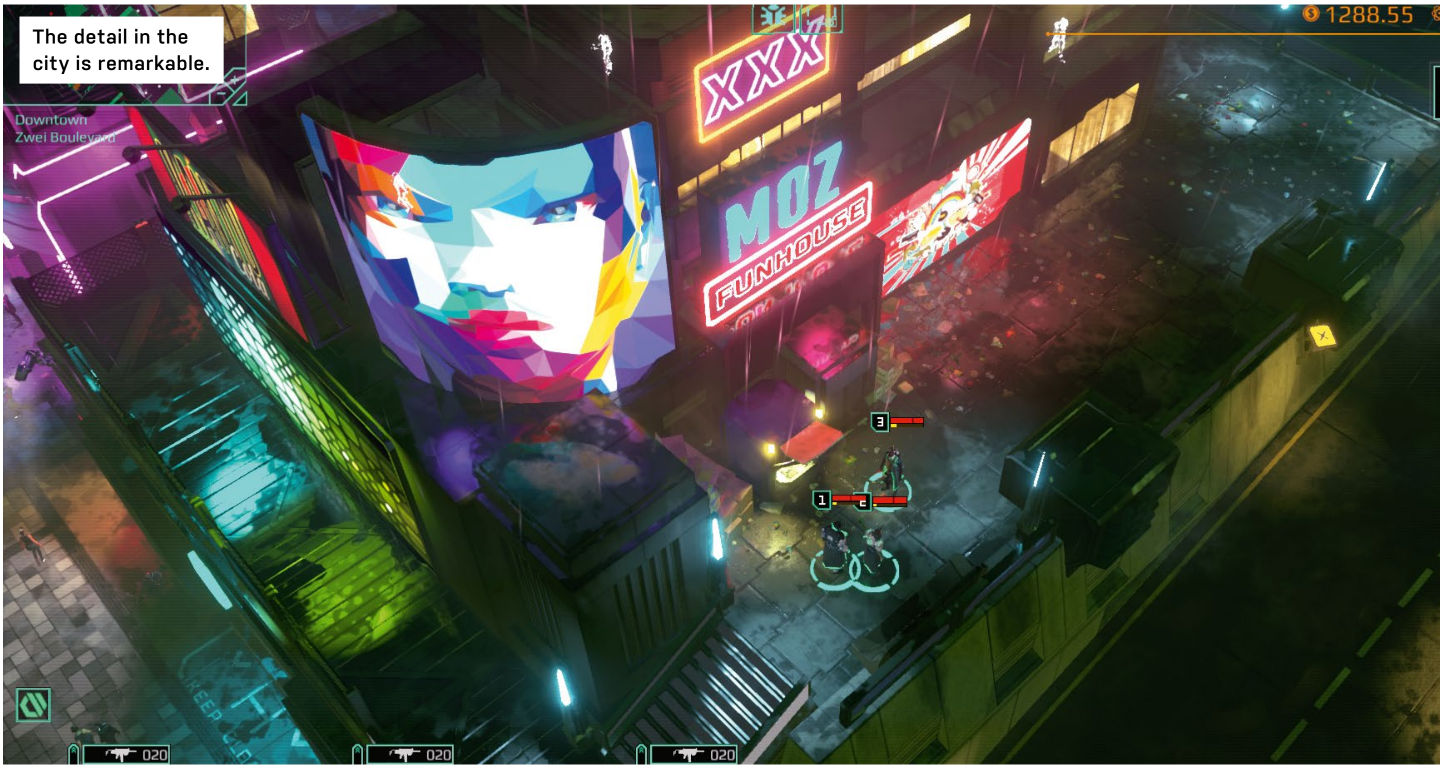
Dirt Rally

⊞ **BHP** Handling realism; car selection; tough tracks.

⊟ **DMV** Needs more locations and authentic car liveries.

RECOMMENDED SPECS FX-8150 / Core i5-4670K; 8GB RAM; R9 290 / GTX 780.

£30, www.codemasters.com, PEGI: 12



The detail in the city is remarkable.

Satellite Reign

Open-ended cyberpunk strategy on rainy neon streets

THE RAIN NEVER STOPS falling on *Satellite Reign*'s isometric future-city. It's derivative of countless cyberpunk cityscapes, but amazingly atmospheric, regardless. Video ads cycle on huge billboards, reflected in puddles on the pavement below. Police drones float through the gloom, spotlights scan for trouble and futuristic cars buzz along the roads. It's like *Blade Runner*… if Ridley Scott had filmed it with a tilt-shift lens.

It's in this dystopian urban sprawl that you, owner of a small corporation with big ideas, must make your mark – which is easier said than done when the mega-corporations and their military-grade security forces have a monopoly on everything. Starting in the downtown area – a bustling, labyrinthine world of neon – your path through this open-world city is the one you carve. You can do missions in any order, in any way you please.

EXPLORING THE MAZE

The action is viewed from above, and you control your four customisable super-agents with traditional RTS controls. It's reminiscent of *XCOM: Enemy Unknown*, but real-time rather than turn-based. Your guys can dash for cover, and their accuracy in a gunfight is determined by range and weapon, enemy position and by their abilities – which can, of course, be upgraded. You can flank enemies to get the jump on them, snipe from afar, or charge in for a melee attack.

But while games like *XCOM* and *Shadowrun* limit you to closed-in levels, *Satellite Reign*'s open city lets you seamlessly move from the anonymity of the streets – where you can hide in the bustle – to a mission, attacking a rival's factory or robbing a bank. These guarded spaces are levels of a sort, but they sit in the open world, waiting to be attacked or infiltrated.

It's daunting at first. The starting area is enormous, and there's so much intricate detail on those maze-like streets that you can feel lost. It's when you see a thick wall, gun-toting guards and warnings to stay away that you know you've encountered somewhere to assault or rob, and that's when the game gets really good.

You have four agents, but that doesn't mean you have to use them all. The most satisfying moment for us was deciding to rob a bank with the security of Area 51, and managing to pull it off with one character: a hacker. We carefully hacked through security gates, dodged cameras and patrolling guards, and made our way towards the main building. We slipped inside and hacked their systems, so that 'siphons' we'd attached to ATMs around the city would generate more money. Then we snuck out, and the corporation we'd ripped off was none the wiser.

That's just one way, though. We could have fought our way into the main building with all four agents, guns blazing, then sent our soldier in to grab a big pile of money for a more immediate reward. There are no interiors in this game: these moments happen off-screen, via a text summary of what your agent did inside. But considering the size of the city, we don't mind. Combining your agents' skills, augs and weapons, and choosing how to approach a mission, is where *Satellite Reign* is at its best.

REMOTE ACCESS

Our biggest complaint is how the game feels. It has none of the punchy, kinetic weight of *XCOM* or *StarCraft*, which top-down games like this need to compensate for your distance from the action. Your agents' movement is slow and heavy, making the battles feel sluggish. It's a hard thing to articulate in words. It just lacks the slickness of many of its peers.

This is an issue that haunts every moment of the game, but otherwise, *Satellite Reign* is one of the most enjoyable small-squad strategy games we've played in ages. We love how it blends tactical combat with an open-world structure and *Deus Ex*-inspired freedom. Creeping through a heavily defended enemy base unseen is a thrill, and if things go awry, there are plenty of combat options to experiment with. –ANDY KELLY

VERDICT 8

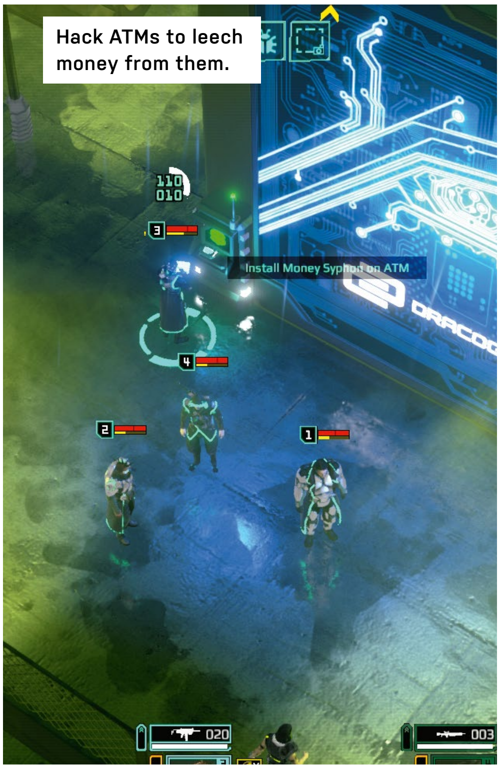
Satellite Reign

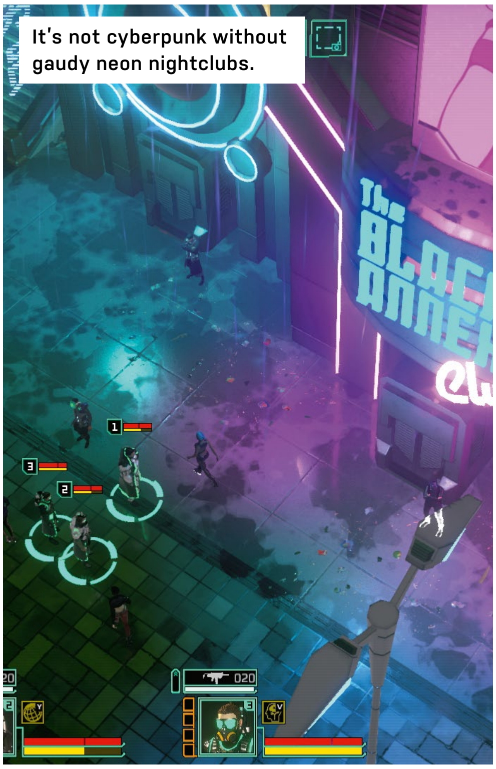
⊞ **BLADE RUNNER** Satisfyingly freeform missions; rich game systems; really pretty cyberpunk city.

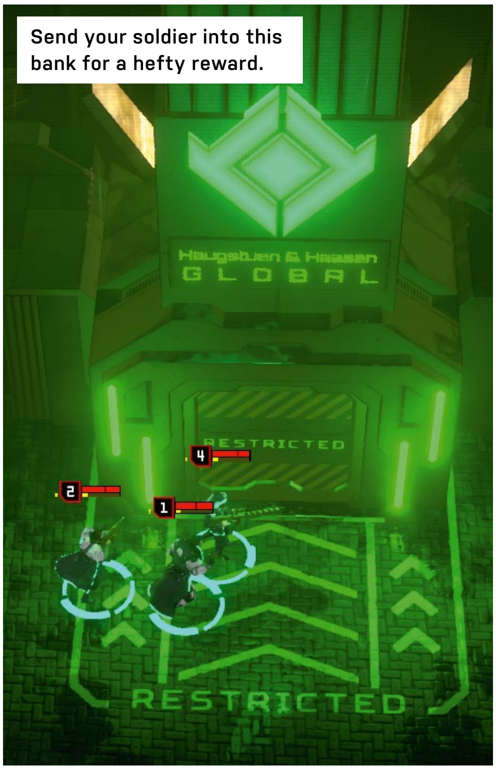
⊟ **JOHNNY MNEMONIC** Sluggish movement; reliant on text summaries.

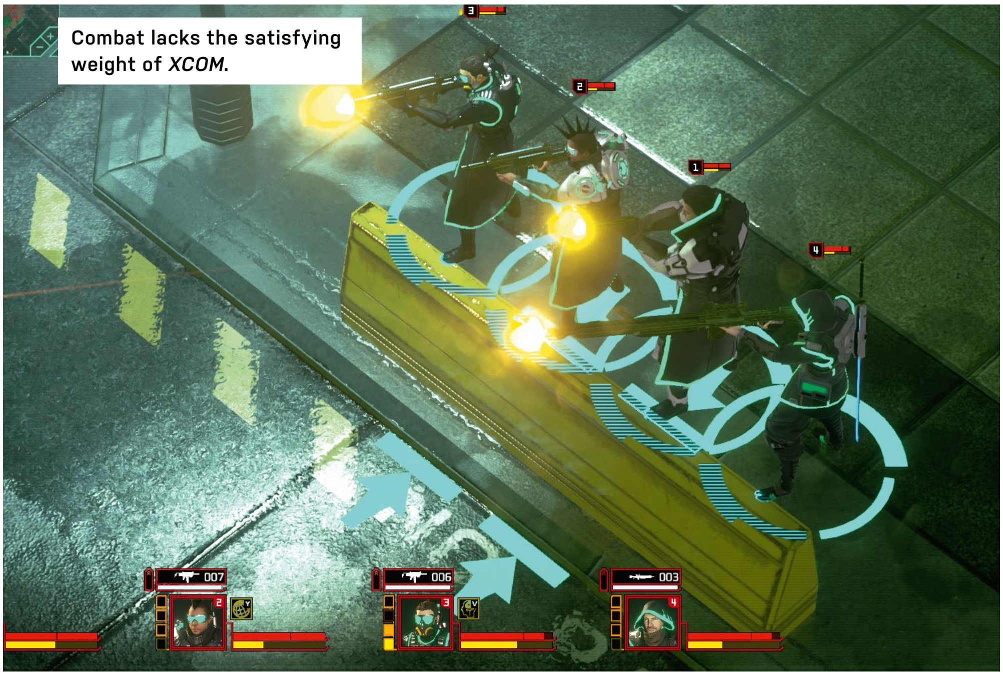
RECOMMENDED SPECS Quad-core 3.4GHz CPU; OpenGL 3.2+ GPU; 4GB RAM.

£23 , www.satellitereign.com, PEGI: NR


Hack ATMs to leech money from them.
Install Money Syphon on ATM
DRACO

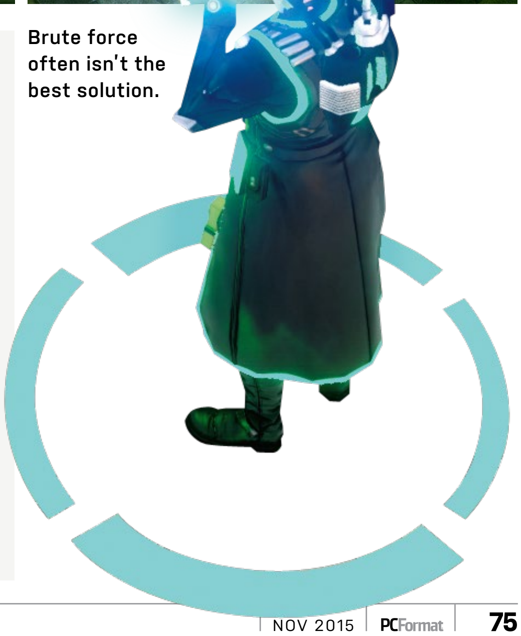

It's not cyberpunk without gaudy neon nightclubs.
The BLACK ANNEX


Send your soldier into this bank for a hefty reward.
Haugsbuen & Hassan
GLOBAL
RESTRICTED
RESTRICTED


Combat lacks the satisfying weight of *XCOM*.

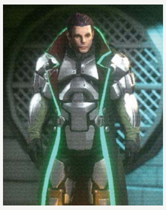
The hard-working agents opt for a team-building night out.

Choosing how to approach each mission is the game's real strength.


Brute force often isn't the best solution.

GANG OF FOUR

What your agents can do

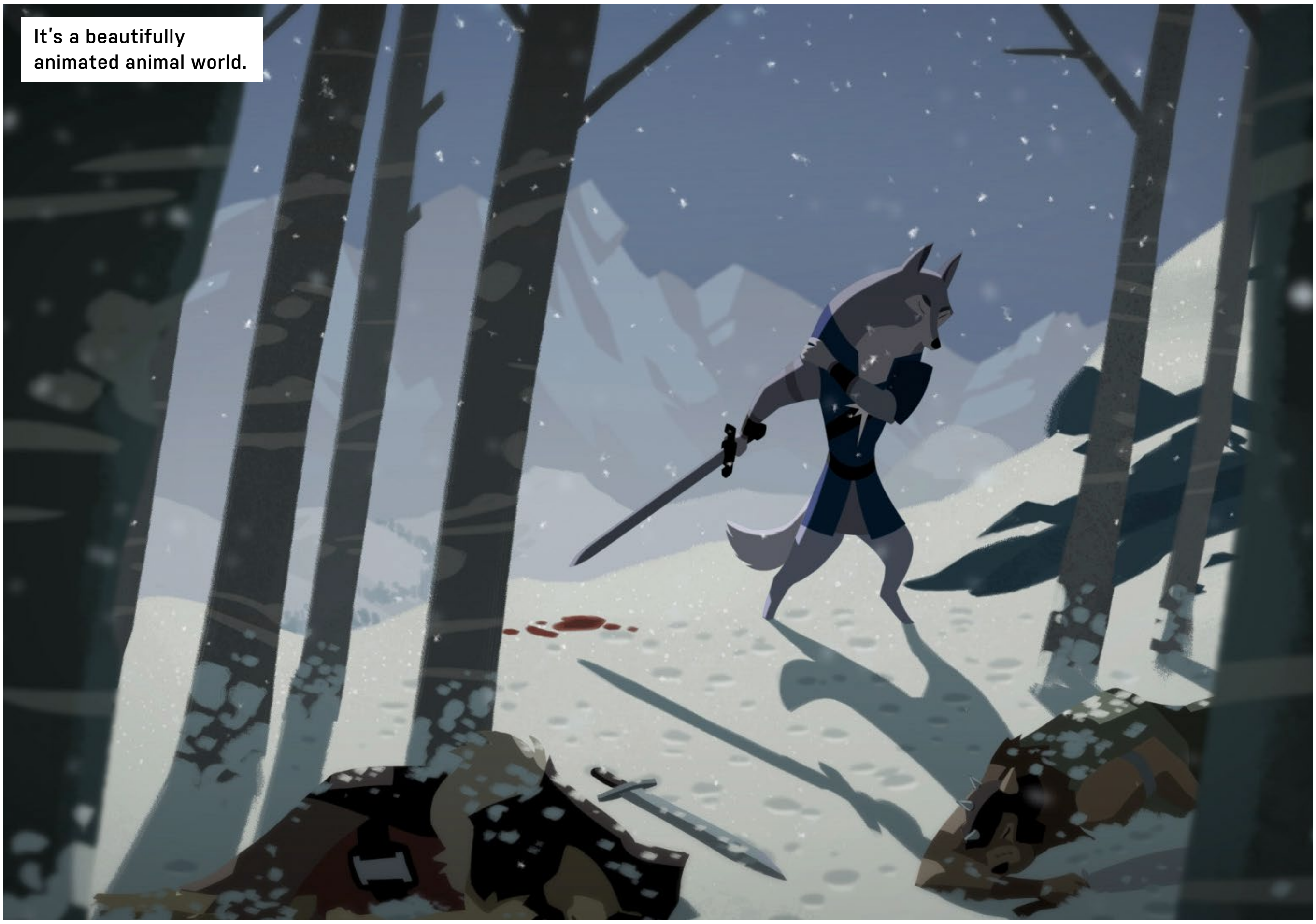


Soldier
The muscle. Gets his point across with miniguns, tactical nukes and plasma shotguns.

Support
Backup. Supplies extra ammo and can extend your line of sight with camera drones.

Hacker
IT Support of the future. Can hack security systems and hijack cyber-brains.

Infiltrator
The cyber-ninja. Can turn invisible for a short period, enjoys swords and sniper rifles.



It's a beautifully animated animal world.

Armello

A dark fantasy board game inspired by *Redwall*

IN THE KINGDOM of Armello, the mad lion is king. That might sound like bad poetry, but *Armello* is a strange game – hugely familiar, but also extremely unusual. It's a board game, definitely, but one that's been developed just as a computer game, so it can do things board games never could.

You take control of one of four characters, leaders of factions in the peaceful kingdom of Armello. Well, it used to be peaceful. The king has been infected by a disease called the Rot. He's slowly dying and succumbing to madness at the same time, and – like in The Fisher King legends – the realm is also suffering, with dungeons opening up across the land, spitting out winged banes that terrorise the towns of the world. The King's Guard is struggling to contain them.

Your task is to save the kingdom – either by curing the king, or killing him, or being the most prestigious faction leader when he succumbs to the Rot. Oh, and all the characters are animals. Beautifully animated, wonderfully drawn cute animals. The king's a lion, the guards are dogs and the banes are vultures.

You get to choose between a wolf, bear, rabbit and rat. Each has a different play style and different levels of strength, body, wit and magic, so they specialise in the various interactions around the world. The wolf is an out-and-out killer, hunting down other animals. The bear can kill the banes with ease, but is poor at combat. The rabbit is best at exploring dungeons. And the rat is best at dirty tricks and making money.

THE HEX FACTOR

The world is hex-based, built around the king's palace, and each character moves around it slowly, grabbing treasure, pursuing quests, defeating banes, exploring dungeons, capturing towns and stumbling into perils. The depth of the world is comparable to *King of Dragon Pass* or *Pillars of Eternity*, a tightly described world shown off in delightfully animated card designs.

Each player has a hand of cards that gets refilled every turn. Each card can either be used as is, to give you treasure or to cast a spell or to summon a peril, or discarded to give you a bonus during combat or a peril. Certain actions or outcomes give your character the Rot, too, which slowly kills them. When a player dies, they return to their starting position and lose prestige.

All these systems gel really well together, leaving a tight virtual board game that feels like *Small World*, but is asymmetric, so players are each striving to win the game in a different way. After a couple of goes, you'll really understand how the game works – and have also unlocked some new items that modify how it plays, too.

It has to be admitted that, despite having this joyous world to play in, the single-player option does get a bit, well, samey. It's also very slow. The solution is to concentrate on playing multiplayer with friends (the game is sold as a four-pack for that reason), vary which character you play as, and to grab the four new characters when they're released, which will add much more variety to the game.

Despite that, *Armello* is a smart, beautiful game that's small enough to understand easily, but complex enough that it's hard to master. Play it with your friends!

–DANIEL GRILIOPOULOS

VERDICT 7

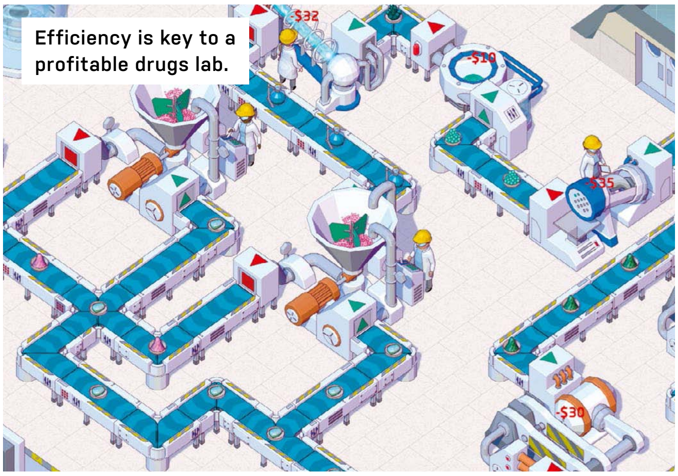
Armello

HOT SHOT Beautiful design; unusual board game systems; great multiplayer.

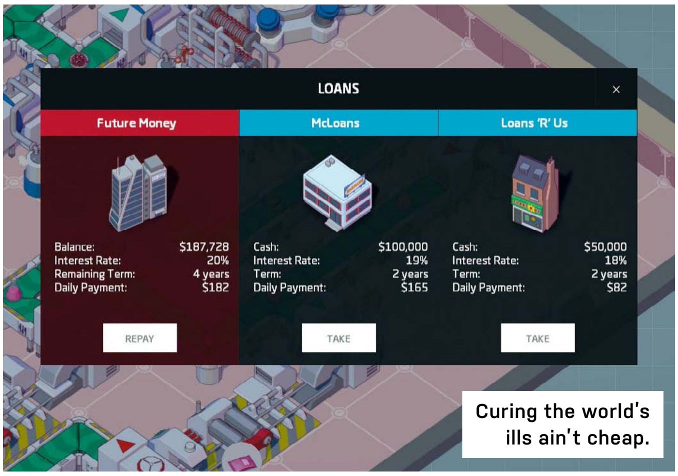
GOT THE ROT Single player game can feel a bit limited.

RECOMMENDED SPECS Quad-core 2.5GHz CPU; DX11-class GPU; 4GB RAM.

£15, www.armello.com, PEGI: 7



Efficiency is key to a profitable drugs lab.


LOANS

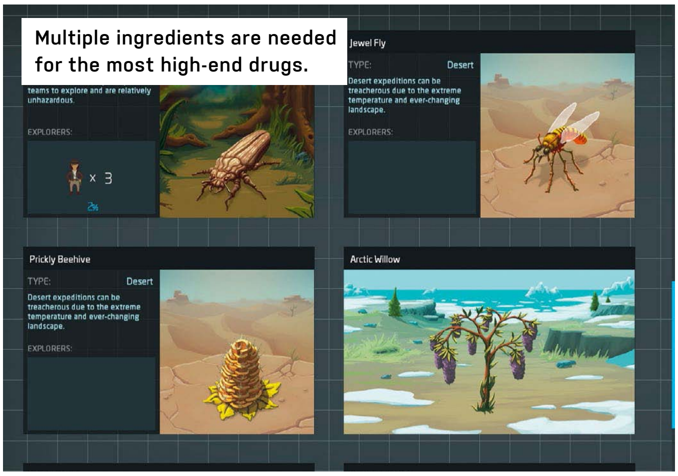
Future Money
Balance: $187,728
Interest Rate: 20%
Remaining Term: 4 years
Daily Payment: $182

McLoans
Cash: $100,000
Interest Rate: 19%
Term: 2 years
Daily Payment: $165

Loans 'R' Us
Cash: $50,000
Interest Rate: 18%
Term: 2 years
Daily Payment: $82

×
REPAY
TAKE
TAKE

Curing the world's ills ain't cheap.


teams to explore and are relatively unhazardous.

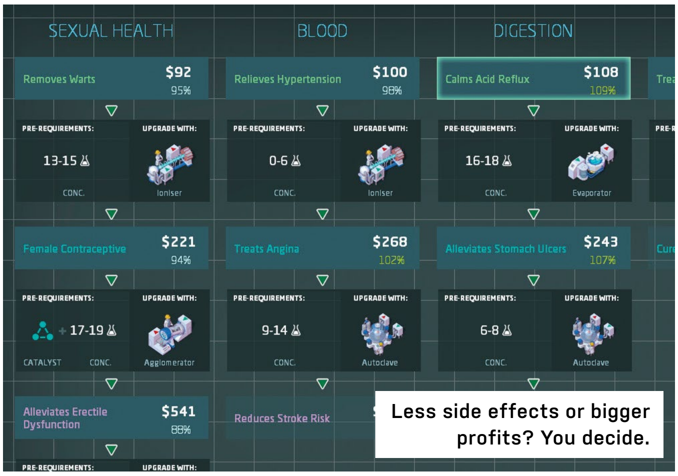
EXPLORERS: × 3 2%

Jewel Fly
TYPE: Desert
Desert expeditions can be treacherous due to the extreme temperature and ever-changing landscape.
EXPLORERS:

Prickly Beehive
TYPE: Desert
Desert expeditions can be treacherous due to the extreme temperature and ever-changing landscape.
EXPLORERS:

Arctic Willow

Multiple ingredients are needed for the most high-end drugs.


SEXUAL HEALTH
BLOOD
DIGESTION
Removes Warts $92 95%
Relieves Hypertension $100 98%
Calms Acid Reflux $108 109%
PRE-REQUIREMENTS: 13-15 CONC.
UPGRADE WITH: Ioniser
PRE-REQUIREMENTS: 0-6 CONC.
UPGRADE WITH: Ioniser
PRE-REQUIREMENTS: 16-18 CONC.
UPGRADE WITH: Evaporator
Female Contraceptive $221 94%
Treats Angina $268 102%
Alleviates Stomach Ulcers $243 107%
PRE-REQUIREMENTS: CATALYST + 17-19 CONC.
UPGRADE WITH: Agglomerator
PRE-REQUIREMENTS: 9-14 CONC.
UPGRADE WITH: Autoclave
PRE-REQUIREMENTS: 6-8 CONC.
UPGRADE WITH: Autoclave
Alleviates Erectile Dysfunction $541 88%
Reduces Stroke Risk
PRE-REQUIREMENTS:
UPGRADE WITH:

Less side effects or bigger profits? You decide.

Big Pharma

The drugs don't work… but they sell like hot cakes

THEME HOSPITAL games have mostly avoided medicine. In fact, let's face it, games mostly avoid difficult themes – probably because titles like the superbly depressing environmental destruction simulator *Fate of the World* have a tendency to not sell well. And we suspect the *Democracy* series only sells because the results of political and economic decisions within it are so apocalyptic. *Big Pharma*'s tack is more on the manufacturing side, which makes it closer to logic games such as *SpaceChem*. Except its focus is the drugs industry.

Here you're a manager of a pharmaceutical firm. You start with a handful of unlocked ingredients, a couple of simple processing machines and a small amount of floorspace to work in. Then you get to work out what drugs you can make that will be profitable, that are competitive against other drugs and not packed with tons of horrible side effects.

Making those decisions is hard and expensive. The cost of ingredients and machines is high relative to the profit you'll earn from them. Discovering new ingredients by exploring distant lands is expensive – both in the high up-front hiring costs and cheaper day-to-day expenses. Researching new machines to improve your processes is also expensive. Using the analysis machine to determine peak concentrations is expensive. And removing side effects can be terrifyingly expensive.

And the core mechanic is hard to grok. Each ingredient has positive aspects – like curing heartburn – and negative ones – like causing flatulence. Each positive aspect can be upgraded into a higher-value treatment by certain processes, and some negative aspects can be removed in the same way. Each aspect also has a concentration at which it is active, and another at which it's at maximum strength. The best drugs will have all their positive aspects maximised, all the side effects removed and be packaged in a nice profit-enhancing form.

MONEY OVER MORALITY

To do that, you use your processing machines to raise and lower the concentration, connect them with belts to transfer the material, and encapsulate them as pills, creams and so on. Each factory area only has a certain number of inputs, so efficiency of design is vital.

Joyously, there are several sandbox modes that let you play the game in tons of different ways, as a well as a custom game mode. For us, the best way to play it at the start was as a custom game without competing companies, as struggling against your budget to make an effective drug was difficult enough for a beginner.

Though it's very clean to look at, *Big Pharma* doesn't have the pure elegance of *Infinifactory* or *SpaceChem*, as its puzzles are as much about generating generic problem-solving revenue. Also, the necessity for plugging conveyer belts rather than connecting machines directly everywhere is slightly forced. Finally, it also, despite its theme, doesn't make any moral comment on the drugs industry, which is surprising.

Big Pharma is a smart game for players who love hard puzzles. The fact it's about drugs is by-the-by, but it's a clean-looking product that's mentally healing, without being too addictive. **–DANIEL GRILIOPOULOS**

VERDICT 7

Big Pharma

➕ **RED PILL** Looks great; good puzzles; pleasingly difficult; tons of game mode options.

➖ **BLUE PILL** Puzzles can feel forced; moral commentary strangely absent.

RECOMMENDED SPECS Quad-core 2GHz CPU; GeForce 700 series GPU; 8GB RAM.

£19, www.bigpharmagame.com, PEGI: NR

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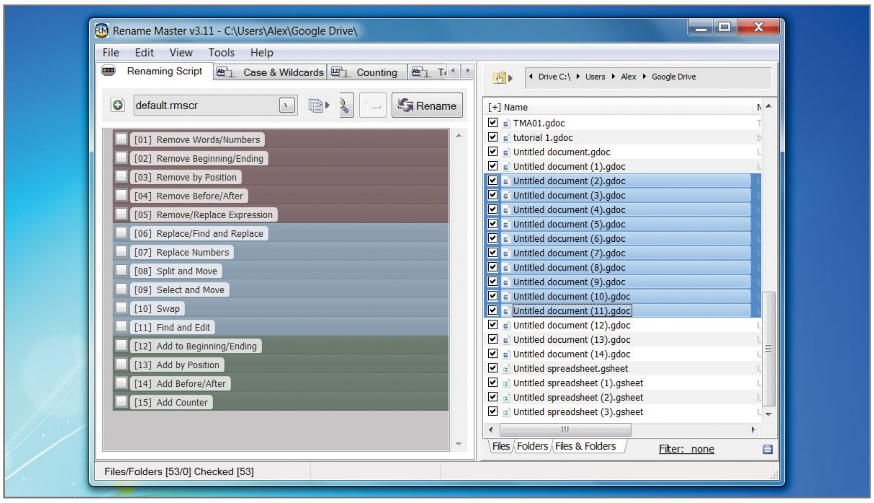
Rename Master v3.11 - C:\Users\Alex\Google Drive\
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Edit
View
Tools
Help
Renaming Script
Case & Wildcards
Counting
default.rmscr
Rename
[01] Remove Words/Numbers
[02] Remove Beginning/Ending
[03] Remove by Position
[04] Remove Before/After
[05] Remove/Replace Expression
[06] Replace/Find and Replace
[07] Replace Numbers
[08] Split and Move
[09] Select and Move
[10] Swap
[11] Find and Edit
[12] Add to Beginning/Ending
[13] Add by Position
[14] Add Before/After
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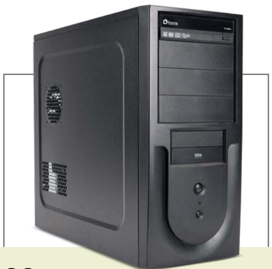
Untitled spreadsheet (1).gsheet
Untitled spreadsheet (2).gsheet
Untitled spreadsheet (3).gsheet
Files
Folders
Files & Folders
Filter: none
Files/Folders [53/0] Checked [53]

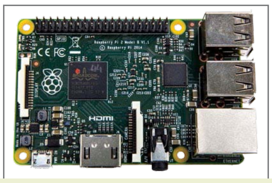
GET ORGANISED WITH RENAME MASTER

Few things annoy us more than the filenames that cameras give to photos. We get that it doesn't just *know* to call it 'Alans-birthday-surprise-2', but that doesn't make it any less frustrating. That's where free utility Rename Master (http://bit.ly/1XarlNF) comes in. It makes it super-easy to rename whole batches of files, whether they are pictures, videos or songs.

MAKE – USE – CREATE



80
Breathe new life into an old PC



84
Set up your own cloud service

90
Record apps in Windows 10

ANDREW WESTBROOK
PRODUCTION EDITOR

CAN YOU HEAR VOICES?

Yes, the Windows 10 frills and fancies are all very exciting. But let's face it, even if the not-inconsiderable privacy issues don't leave you squinting all suspiciously at the Redmond outfit, there's bound to be a utility or two that inspires a distinct feeling of, well, meh.

One-such feature could be the new-fangled, much-hyped and admittedly sometimes-impressive digital personal assistant known as Cortana. Yes, it has become far more integrated. And yes, it has much improved its skills across a wide variety of uses. And yes, that's all on top of also being a decorated war vet. But it ain't all rosy. If you occasionally enjoy using non-Microsoft products, that is.

However, while Cortana unsurprisingly defaults to Microsoft's search engine Bing, that's not the way it has to be. If you have Chrome as your default browser, then grab the Chrometana extension. This redirects Cortana searches to your search engine of choice, such as DuckDuckGo or Google, rather than Bing.

Indeed, if you generally prefer the cut of Google's voice-control jib, you can take this further by enabling Google's voice search, which is disabled by default. Just open Chrome and type 'chrome://settings/' into the address bar. In the search section, check the 'Enable OK Google' box, then open a new tab and say "OK Google", followed by a command. This performs a simple Google search, and includes tools such as the calculator, calendar and Wikipedia summaries.

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BUILD IT

BY ALEX CAMPBELL

Breathing New Life into an Old Box

An upgrade can give your ageing PC a new round of usefulness, even with older architectures

LENGTH OF TIME: **1 HOUR**

LEVEL OF DIFFICULTY: **EASY**

THE MISSION

HERE AT *PC FORMAT*, we often build new rigs from scratch. We have the option of using just-in, bleeding-edge, nerd-porn-worthy parts, or remixing a fresh build idea from our selection of parts we've already built and reviewed. Either way, builds usually use newer-generation parts. New! Shiny!

This isn't one of those builds. We know that not everyone can, or has, the desire to go out and build a whole new PC every time. In fact, one of the best parts of building a PC is the fact that you can upgrade a system as it begins to show its age. We were digging around in the pile of parts that is the PC Format Lab, and we found a frumpy-looking gem: an LGA1155-based Core i5 budget build from 2013.

Yes, this already less-than-attractive case didn't get any prettier with time. But with a little TLC, we were able to resurrect this rig and get it a little more up to speed.

PLEXTOR
PX-806SA
Qflix
USB
USB PORT

INHALE

IN OUR ORIGINAL BUILD, the PC had a quad-core i5-3350P at its heart. The CPU served the rig well against the competition two years ago, and cost £135 back then. If you can still find it, it now runs about £126. We'd mounted the CPU onto a £42 ECS H77H2-M3 mobo, which is a basic board that gets the job done. The same mobo is £30 today, though finding one won't be easy.

For memory, we'd gone with a low-profile Kingston 4GB kit of DDR3 1333. The kit was about £26 back then and is around £18 now. The Gigabyte GeForce GTX 660 OC got replaced with a more modern GTX 970 in our upgrade. The old GTX 660 cost £145 two years ago, and can be found for £157 online today.

The storage options were modest as well. The A-Data 32GB SSD, 500GB WD Caviar Blue, and Lite-On iHAS DVD+RW didn't exactly set the world on fire, and cost £30, £32 and £10, respectively. The SSD still costs about £30, while the HDD is available for a bit more, at £42. We found the iHAS for £9.

As for the Rosewill case, it's no longer available. When we got it, the basic steel case cost around £40. With a copy of Win8, the rig cost £535. Without the OS (£75), the total dropped to £460. With current pricing and without an OS, the PC would cost about £452 today. That's about the same as a decent GTX 980. As for our upgrades, we gave this little rig new wings at a cost of £507.

INGREDIENTS

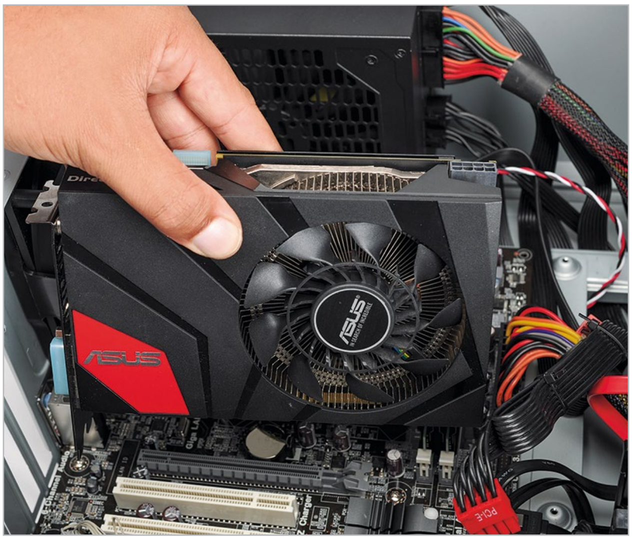
PART		STREET PRICE
GPU	Asus GTX 970 DCMOC	£263
Memory	Patriot Viper 3 8GB DDR3 1600	£64
PSU	Rosewill Photon 650W 80 Plus Gold	£59
HDD	Seagate Barracuda 1TB	£35
SSD	Samsung 850 Evo 250GB	£76
Fan	Corsair AF140 White	£10
Total		£507

1

EYE IN THE SKY

THE GTX 970 WE UPGRADED to was by far the most expensive investment in the upgrade. At £263, this GPU is a good £100 more than a GTX 960 that has nearly the same form factor. Since we went with a 660 OC in the original build, we wanted to put in a card that had clear performance gains, but wouldn't let the modest Core i5 hold it back. Even though we regularly build with GTX 980s and above, the GTX 970 is still a very capable graphics card for 1080p gaming.

The GTX 970's modest TDP of 145W meant that we didn't have to go crazy with our power supply, either. The card only takes a single 8-pin power connector, which is nice considering the lack of cable management options in the case.

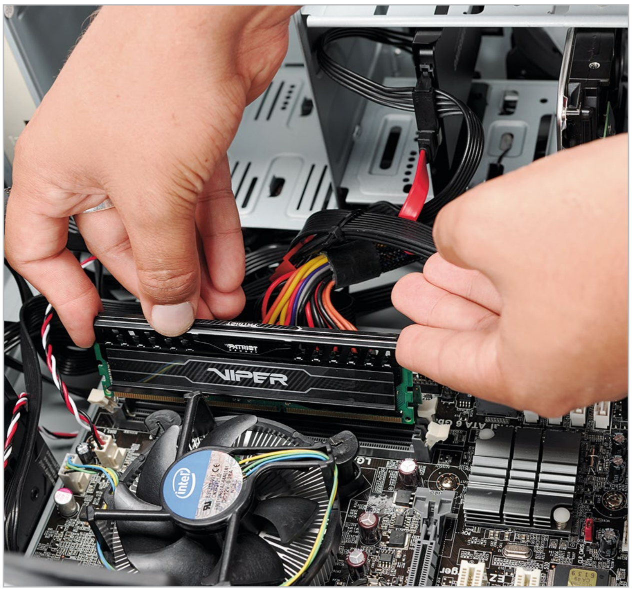


2

A LITTLE MORE LIFT

WE KNOW THAT it could be argued that 4GB of memory is plenty for a budget rig, but we really feel that 8GB makes the OS and any games feel a lot more comfortable. After all, there's a good chance you won't be gaming all the time. Browsers, photo editors and audio applications all get memory-hungry. Eight gigabytes should be enough to satiate them in pretty much most circumstances.

These two 4GB 1,600MHz sticks of Patriot's Viper 3 line were taken from a four-stick 16GB kit we had on hand here. While that kit is a bit more pricey, we looked up the 8GB kit and found it to be around £65. That's not too far off course as far as RAM prices go, so we didn't hesitate to use these two modules. Another thing to notice is that this mobo only has two DIMM slots, so more RAM would require DIMMs with higher capacity. That costs money, another reason to keep it at 8GB.



3

INCREASED LUNG CAPACITY

IF THERE'S ONE THING we wanted to upgrade, it was the SSD. Solid-state media has got much cheaper, so we thought it would be reasonable to put money into a higher-capacity and -performance SSD. While the Samsung 850 Evo won't blow your hair back, it's still very speedy. At 250GB, we thought it well worth the £76. For that money, you can have your OS, Steam library and a good number of apps all on one drive.

We left in the original 500GB WD Caviar Blue and added in a 1TB Seagate Barracuda. Hard drives can and will fail. Using the Barracuda as a backup for the WD is reasonable. On the flip side, hard drives tend to have a lifespan of about five years. Since this rig is two years old, we could also use the Barracuda as primary storage and the WD as backup for three more years. This should minimise writes and extend the drive's life a little more.

4

INTO THIN AIR

WHEN WAS THE LAST TIME you saw a case that mounted the power supply up top? For us, it's been quite a while. With few exceptions, modern cases place PSUs on the bottom. There are plenty of reasons for this: to make way for exhaust fans and cooling radiators, to help dissipate heat more effectively and because installing a heavy PSU above a bunch of pricey components is an unnecessary risk.

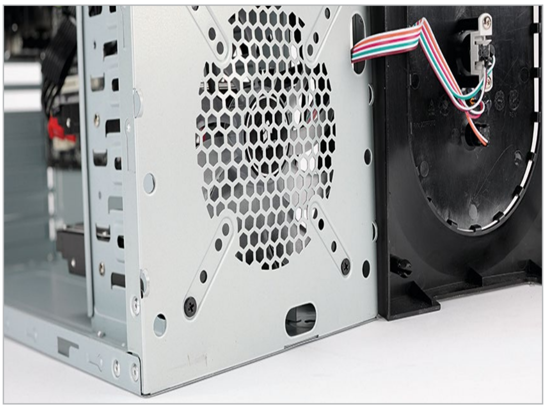
We'd used a cheapo PSU that came with the case. We decided to replace it with a 650W unit from Rosewill. The PSU is 80 Plus Gold certified, which means that it will actually use more of the power it draws from the wall, not just dissipate it as spare heat. The unit also comes with a five-year warranty, which means that by the time you upgrade the CPU and motherboard in this rig, it will probably still have plenty of life left in it.

5

THE JET STREAM

ONE THING WE NOTICED was the lack of a front fan. With the original configuration, heat wasn't a big issue. And, to be fair, the rear fan has a healthy airflow rate. However, we felt that with an extra HDD and a stock CPU heatsink and fan, a little extra air couldn't hurt.

To install the 140mm Corsair case fan, we had to pry off the plastic front panel. From there, we were able to use case fan screws to attach the white LED fan. Easy enough. What we didn't anticipate was the lack of an extra PWM fan connector on the mobo. The H77H2-M3 only has two PWM pinouts: one for the CPU fan, one for a case fan. Lucky for us, the SATA power cables for this PSU have Molex connectors on their ends. We found a Molex-to-PWM connector and plugged it into one of the SATA cables without a problem.

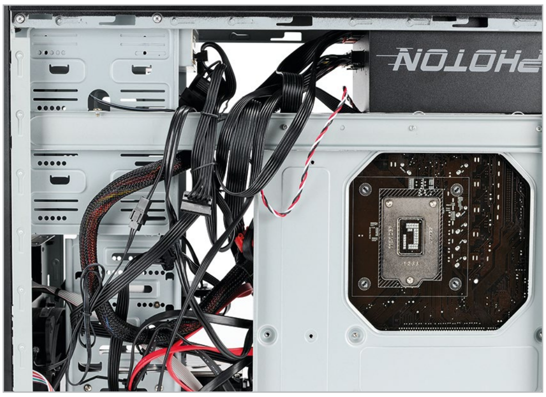


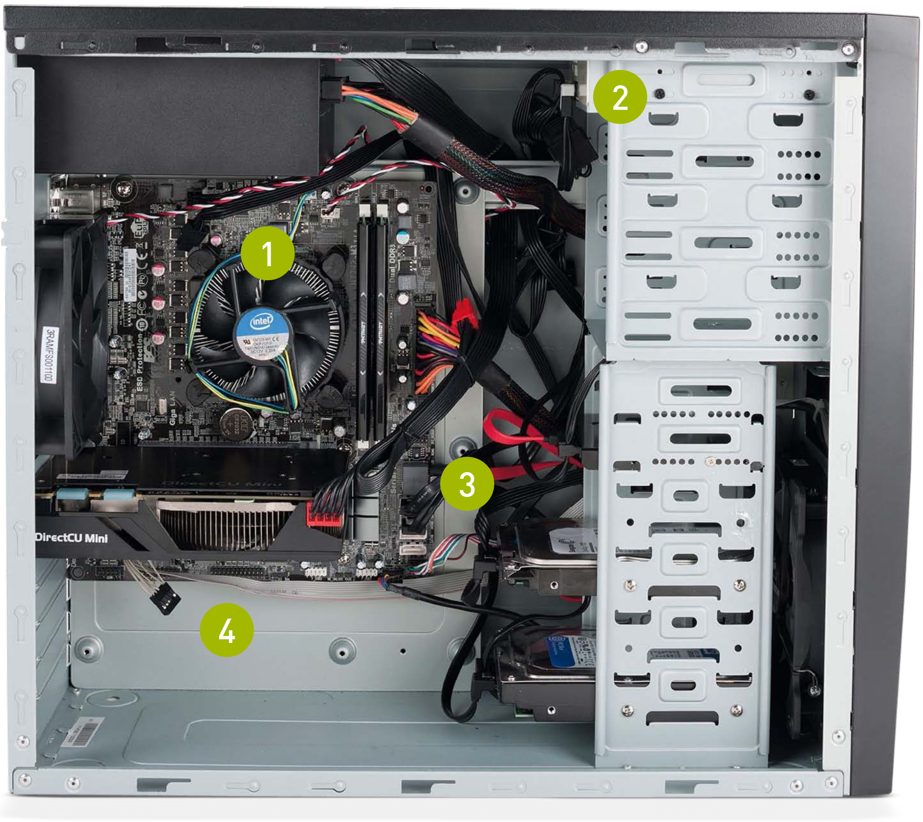
6

GASP!

IMMEDIATELY OBVIOUS with this case was the utter lack of cable management. In terms of PC cabling, we like our builds to be as organised as possible, but this is the stuff of nightmares. What seems like an obvious route for cables – over the horizontal rail and behind the drive bays – is made impossible by a side panel that has an inward (inward!) bevel. When we tried to keep cabling tucked behind the mobo tray, we felt like the case was making fun of us. "Oh, that's cute," it would say. "I bet you'd just love an extra centimetre. Tough luck, hotshot."

Coupled with the woefully insufficient zip ties that came with the PSU, this cable job could have you waking up in cold sweats. We had to stuff the cables behind the drive cage, doing our best to keep them out of the way of the front fan's air flow. The wiring still looks like a mess.





1 We didn't bother adding an aftermarket cooler for this Core i5-3350P. The locked CPU doesn't allow for overclocks and is plenty cool, as-is.

2 We didn't go with a Blu-ray and instead stuck with a basic DVD+RW. We popped in a basic Plextor model because, when we found this box, the original drive was missing.

3 Only two of the six SATA cables have horizontal ports, which excluded longer GPUs from being used on this mobo. Luckily, our GTX 970 is pretty short.

4 The long grey ribbon cable is for the front panel audio. We had to make sure we disconnected this before removing the panel to prevent bent pins.

EXHALE

WHEN WE SET OUT on this project, we specifically wanted to revisit an older build. Sometimes, upgrading an old PC can feel like hooking up with an old friend you've lost contact with. Some things carry over from the past, but new additions make it different.

However, this wasn't a single cheap upgrade. The total cost of parts we used in the upgrade almost exceeded the original cost of the PC. That said, upgrading the CPU and motherboard would have added another several hundred pounds. By holding on to a slightly older mobo and CPU, we still got a respectable PC for less than the price of a new one. That's not bad, if budget is an issue.

And speaking of budget, these upgrades are totally do-able as incremental upgrades over time. Adding a fan, storage and RAM is relatively cheap and easy to do. The graphics is more expensive to modernise, especially since the PSU upgrade is a good idea for the new GPU. But as time goes by, upgrading the case, motherboard and CPU are certainly possible upgrades that could make this PC more current.

This rig really chugged along in our timed benchmarks. It took half an hour for it to finish the ProShow export, and almost 20 minutes to finish stitching photos. Even though it had four cores, the modest CPU crunched numbers at a pokey 10.3 frames per second in our X.264 benchmark. In our graphics benchmarks, the GTX 970 made a respectable showing. In 3DMark FireStrike Ultra, this build beat another budget build we have, costing about £640, which sports a GTX 960 and i5-4590. It scored about 700 points lower than a £1,200 mainstream build of ours that boasts a i7-4790K and GTX 980.

That midrange PC's CPU and GPU combo alone costs £657 – more than all the combined upgrades that went into this build, not to mention that its CPU is also sitting on a more expensive Z97 board (£142). All things considered, these upgrades provide a marked improvement in performance at a reasonable price.

As for the game benchmarks, *Batman: Arkham City* showed an enjoyably playable 70fps at 1440p, which lets us know that other games will fare well at 1080p, even at higher settings. The GTX 970 couldn't really keep up when it came to 4K gaming, as both *Tomb Raider* and *Middle-earth: Shadow of Mordor* were barely smooth at 28.6fps and 30.6fps, respectively, at 2160p. ■

BENCHMARKS

	TEST RIG	
Stitch.Efx 2.0 (sec)	806	1,165 (-44.5%)
ProShow Producer 5.0 (sec)	1,472	1,805 (-22.6%)
x264 HD 5.0 (fps)	33.8	10.3 (-69.5%)
Batman: Arkham City 1440p (fps)	204	70 (-65.7%)
Tomb Raider 2160p (fps)	87.5	28.6 (-67.3%)
Shadow of Mordor 2160p (fps)	70.1	30.6 (-56.3%)
3DMark FireStrike Ultra	8,016	2,484 (-69.0%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our test rig PC uses a 5960X CPU, three GTX 980s and 16GB of RAM. *Arkham City* tested at 2560 x 1440 Max settings with PhysX off; *Tomb Raider* tested at Ultimate settings; *Shadow of Mordor* at Max settings.

Set Up Your Own Cloud Service

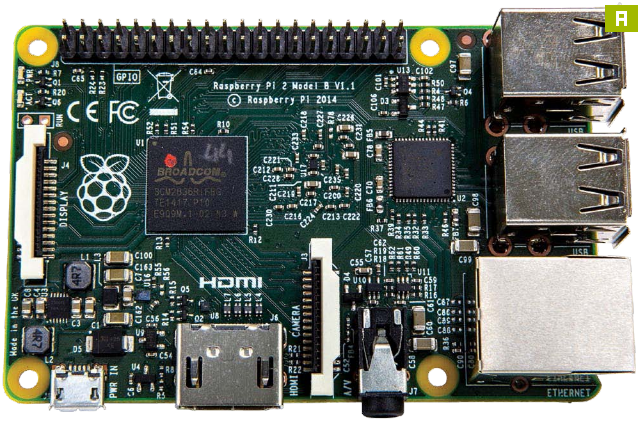
YOU'LL NEED THIS

RASPBERRY PI 2
The brilliant mini-computer costs under £30. See www.raspberrypi.org.

USB PORTABLE DISK
Ideally a self-powered disk that doesn't draw power from the Raspberry Pi.

DO YOU WANT the convenience of an omnipresent Dropbox-like storage service without doling out wads of cash and your data to a third party? OwnCloud is one of the best pieces of open-source software to help you create your own private and protected cloud-sharing service.

Using OwnCloud, you can sync and share your private data, and access it from any device connected to the internet. For added security, OwnCloud can also encrypt your files. The software can handle files in a variety of formats and you can extend its usability by adding a number of other apps. As with other online cloud storage services, you can sync files on OwnCloud either using the web browser or a desktop client on Windows, Mac and Linux, as well as mobile clients for Android and iOS devices. Furthermore, your OwnCloud server keeps older versions of all changed files and enables you to revert to an older version without much effort. –MAYANK SHARMA



A

1

LAY THE GROUNDWORK

In this tutorial, we're setting up the OwnCloud server on top of the Raspbian distribution for the Raspberry Pi [**Image A**]. The server software has modest requirements and it performs well, even on the Raspberry Pi Model B, in certain small and controlled environments, such as your house. You also need a USB portable disk for storing the data. For maximum reliability and performance, it's best to use a self-powered disk that doesn't draw power from the Raspberry Pi. Before you begin setting up the server, make sure the Raspberry Pi has a static IP address. The easiest way to do this is to tie an IP address to your Pi's unique MAC address in your router's admin page. Here, we're assuming the Pi is at 192.168.3.111 – change as appropriate.

2

INSTALL OWNCLOUD

Raspbian is based on the Debian OS, so we can pull in packages from OwnCloud's Debian repository. Fire up a terminal and add the OwnCloud repositories with:

```
$ wget http://download.opensuse.org/repositories/
isv:OwnCloud:community/Debian_7.0/Release.key
$ sudo apt-key add - < Release.key
```

» You can now refresh the repositories with:

```
$ sudo apt-get update
```

» Now install the OwnCloud server and all its required dependencies as follows:

```
$ sudo apt-get install owncloud.
```

» This also pulls in and sets up the MySQL database, and you're asked to set up a root password.

» In addition to installing the required components, the above command automatically configures the Apache web server to talk to the OwnCloud installation. You need to enable certain Apache modules. In a terminal, enter:

```
$ sudo a2enmod headers rewrite env
```

» Then restart Apache using:

```
$ sudo apachectl restart.
```

» You have to tweak the configuration file of PHP if you wish to upload files that are greater than 2MB in size. To do that, open the PHP configuration file, 'php.ini', housed under '/etc/php5/apache2', in a text editor. Look for the 'upload_max_filesize' and 'post_max_size variables' and change their value from '2M' to something like '1024M' or even '2G'. Optionally, on larger installations, you can also install the APC PHP accelerator to make the OwnCloud installation snappier. Pull in the components with "sudo apt-get install php-apc" and then open APC's configuration file and add:

```
$ sudo nano /etc/php5/conf.d/20-apc.ini
extension=apc.so apc.enabled=1 apc.shm_size=12M
```

» Then bring the cache online by restarting Apache with:

```
$ sudo apachectl restart
```

3

MOUNT THE DRIVE

Now that the server is set up and configured, it's time to prepare the storage medium. Plug the USB disk into the Pi and enter "sudo blkid" in a terminal. The USB disk is probably mounted as '/dev/sda1' if you don't have any other USB disks attached. Make a note of the corresponding UUID, which looks something like '6154-F660'. Now create a directory to mount this drive using:

```
$ sudo mkdir /media/owncloud
```

» Then mount the drive with:

```
$ sudo mount -t vfat -o umask=007,auto,uid=33,gid=33 /
dev/sda1 /media/owncloud
```

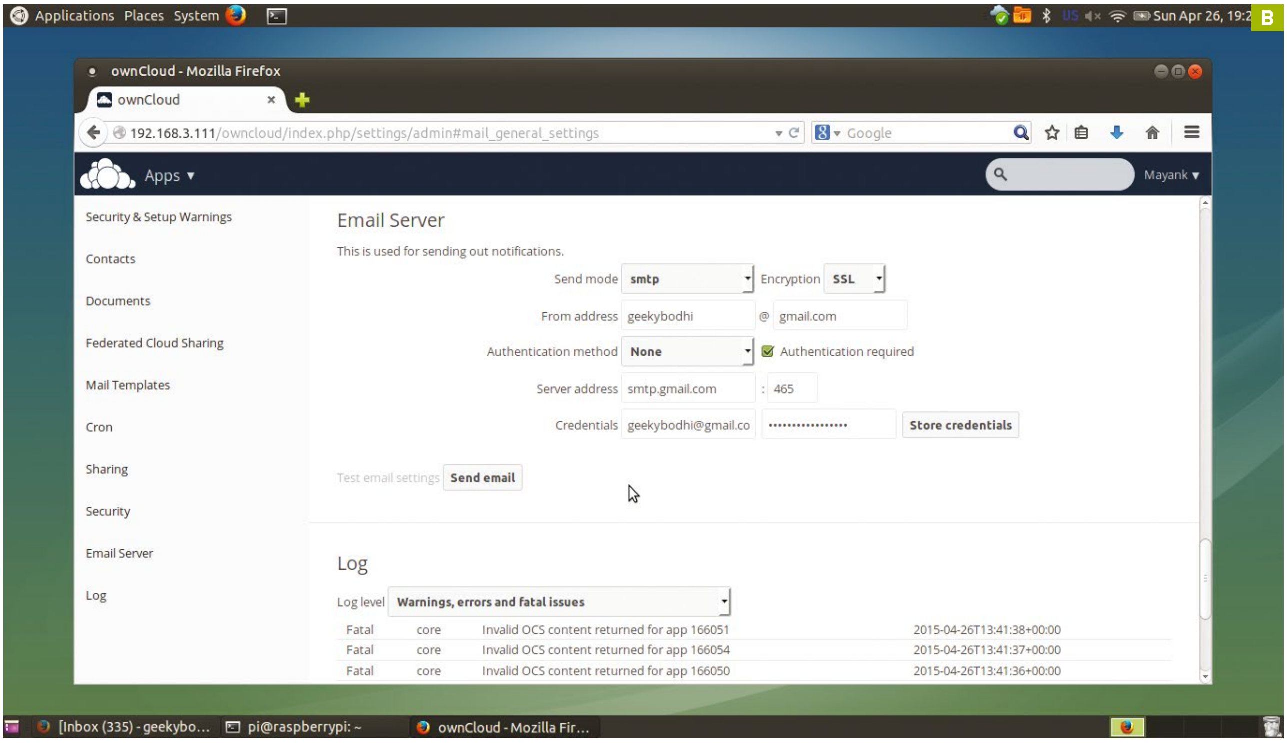
» The above command assumes your drive has a FAT32 filesystem and is mounted at '/dev/sda1'. Once the drive is mounted correctly, you can edit the 'fstab' file to make sure it's automatically mounted:

```
$ sudo nano /etc/fstab
UUID=6154-F660  /media/owncloud/  vfat
rw,umask=007,auto,uid=33,gid=33 0 0
```

4

CONFIGURE THE CLOUD

That's all there is to installing the server components. You're now all set to configure your cloud. Launch a web browser and navigate to the OwnCloud installation instance at '192.168.3.111/owncloud'. Because



B

Email Server

This is used for sending out notifications.

Send mode: smtp
Encryption: SSL
From address: geekybodhi @ gmail.com
Authentication method: None
☑ Authentication required
Server address: smtp.gmail.com : 465
Credentials: geekybodhi@gmail.co ••••••••••••••••
Test email settings

Log

Log level: Warnings, errors and fatal issues

```
Fatal   core   Invalid OCS content returned for app 166051   2015-04-26T13:41:38+00:00
Fatal   core   Invalid OCS content returned for app 166054   2015-04-26T13:41:37+00:00
Fatal   core   Invalid OCS content returned for app 166050   2015-04-26T13:41:36+00:00
```

this is a brand new installation, you're asked to create a new user account for the OwnCloud administrator.

›› Next, we need to ask OwnCloud to use the MySQL database and store files under the mounted USB drive. For this, click the 'Storage & Database' pull-down menu. Then enter "/media/owncloud/data" in the text box corresponding to the 'Data Folder' entry and select the 'MySQL/MariaDB' option in the 'Database' section. You're asked to enter the connection details of the database server, so just enter "localhost" as the host and "root" as the username, along with the password you configured when the database was pulled in along with OwnCloud. That's it – you've set up OwnCloud. You can now log into your cloud server as the administrator using the credentials you've just created.

5 CHANGE SETTINGS

While you can start using the server to upload and download files straight away, let's take a moment to get your house in order. For starters, when you log into the OwnCloud server, click the pull-down menu next to your username and click 'Personal'. Here you can change the settings for your account, such as the login password and display name. You can also add a profile picture and configure how you'd like to be notified about certain actions [Image B].

›› Also, if your cloud is going to be used by multiple people, it's advisable to add users and organise them into different groups. To do this, select the 'Users' option from the pull-down menu. While adding users, you can restrict their storage space and even share your admin responsibilities with other users, and mark certain users as admins for a particular group.

6 UPLOAD AND SHARE FILES

You're now all set to upload data into your OwnCloud server. After you've logged in, you are in the 'Files' section [Image C]. To upload a file, click the arrow button. To organise files into folders, click the button labelled 'New', and select the 'Folder' option from the drop-down menu to create a new folder.

READY-MADE SOLUTIONS

Although it doesn't take too much effort to install and configure the OwnCloud server from scratch, there's a couple of ways to save time and effort. The guys behind PetRockBlog have written a script that automates the whole installation process.

The script downloads and sets up an OwnCloud installation on top of a Raspbian distribution. However, unlike our tutorial, the script uses the Nginx web server, instead of the Apache web server. To use the script, install the required components with:

```
$ sudo apt-get install git dialog
```

Then download the script with:

```
$ git clone git://github.com/
petrockblog/OwncloudPie.git
```

which creates a directory called OwncloudPie. Move into this directory:

```
$ cd OwncloudPie
```

Make the script executable:

```
$ chmod +x owncloudpie_setup.sh
```

Then execute it:

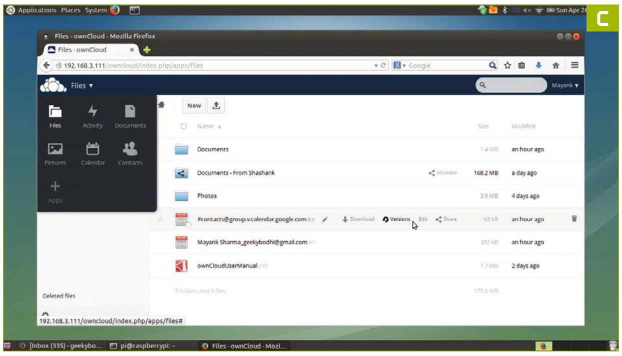
```
$ sudo ./owncloudpie_setup.sh
```

Give it some time to download all the components and configure your server. Once you've installed OwnCloud from the script, you can run it again to update it whenever new versions are released.

If you're the adventurous sort, you can install arkOS (https://arkos.io/) on your Raspberry Pi. In addition to OwnCloud, the distro has other apps to keep you in charge of your data. Head to the downloads page, then download and extract the installer for the Raspberry Pi. Insert an SD card and run the installer with:

```
$ sudo ./arkos-install
```

Follow the steps in the installer to download the image from the internet and install it on to your SD card. Once it's done, boot your Raspberry Pi from it and head to http://arkos:8000 to set up your server.



» If you've uploaded a file in a format that OwnCloud understands, you can click its name to view and edit the file. OwnCloud can visualise the data it houses in different views. For example, click the 'Files' pull-down menu in the top-left corner of the interface, and select 'Pictures'. This helps you view images in your cloud by filtering out all other types of content.

» Another way to upload files to the server is by using the WebDAV protocol, with which you can access your cloud server from your file manager. For example, in the 'Files' file manager, press [Ctrl]–[L] to enable the location area. Here you can point to your OwnCloud server, such as 'dav://192.168.3.111/owncloud/remote.php/webdav'. Once authenticated, the OwnCloud storage is mounted and you can interact with it just like a regular folder.

» To share uploaded files, simply go to the 'Files' section in the web interface and hover over the file or folder you wish to share. This displays several options, including 'Share', which enables you to select which users or groups you want to share the item with and whether you want to give them permission to edit and delete the files.

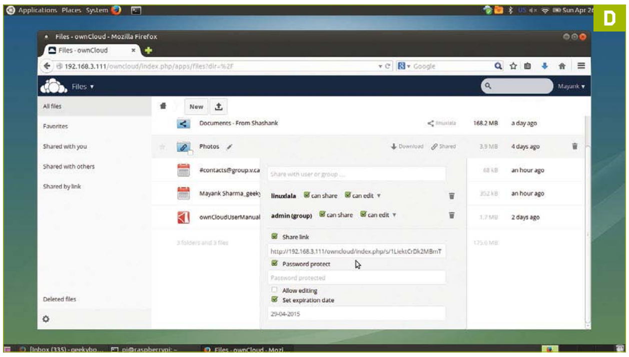
» You can also share with someone who isn't registered with your OwnCloud server. Click on 'Share with Link', and OwnCloud displays a link to the item that you can share with anybody on the internet. You can also password-protect the link and set an expiration date too [Image D].

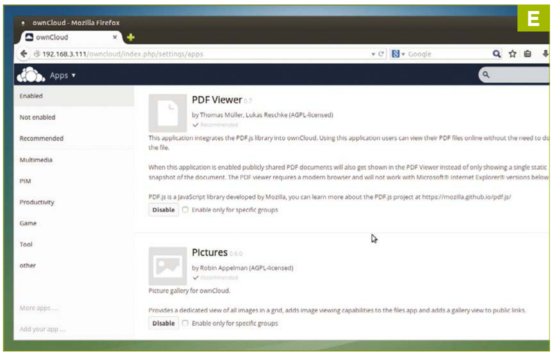
» While you can interact with the cloud using the web interface, it's far easier to use one of its official clients. OwnCloud has clients for all the major desktop and mobile platforms. These clients also help you synchronise folders from the desktop to your OwnCloud server with ease.

7 SET UP CLIENTS

Most desktop distributions host the Linux client in their official repos. You can also grab the latest version by adding the corresponding repo for your distro from here: http://bit.ly/1HZxhOy. The page has instructions for popular distros including Debian, Fedora, Ubuntu, OpenSUSE and more.

» Head to https://owncloud.org/install/#install-clients, the downloads page on OwnCloud's website to download clients for other platforms. Mobile clients are best fetched from either Apple's App Store or Google's Play Store.





» Once the client is installed, it prompts you for your login credentials in order to connect to the OwnCloud installation. Once connected, the Linux clients create a local sync folder named 'owncloud' under the home directory, such as '/home/bodhi/owncloud'. Any files you move into this directory are automatically synced to the server. You can also specify one or more directories on a local machine to sync with the OwnCloud server.

» If a directory is shared with several users, when anyone makes a change to a file on one computer, it automatically flows across to the others. When collaborating with other users, you'll appreciate OwnCloud's version control system, which creates backups of files before modifying them. These backups are accessible via the Versions pull-down option corresponding to each file, along with a Restore button to revert to an older version.

» In addition to files and folders, you can also get your calendar and address book synced with your OwnCloud server.

8 INSTALL AND ENABLE APPS

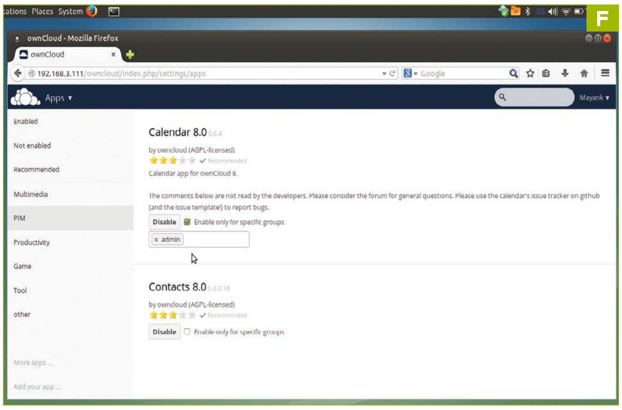
You can extend your default OwnCloud installation by adding (or removing) a bunch of apps. Bring up the pull-down menu in the top-left of the interface and click 'Apps'. By default, you're shown a list of apps that are already enabled on your installation [Image E]. You can browse through this list and read their descriptions to understand them better. You can also disable any enabled app from this section.

» Scroll down and click the 'PIM' tab on the left [Image F]. This section lists two apps. You can enable either or both the Calendar and Contacts apps. Once you've enabled both, the top-left pull-down menu now includes the Calendar and Contacts option.

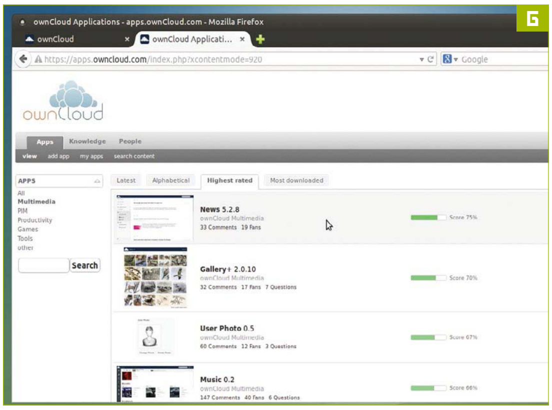
» Now you need to import your contacts and calendar from your existing apps into your cloud server. OwnCloud supports the popular vCard file format (which has the .vcf file extension) and almost every popular email app, including online ones such as Gmail, export their address books in this format.

» Similarly, calendars can be imported in the iCal format. Before proceeding further, make sure you download both the .vcf and .ical files from your existing contacts and calendar apps.

» Now, head to Contacts in OwnCloud and click 'Import Contacts'. In the pop-up window, click 'Upload File' and point it to the .vcf file. Once the contacts have been imported, you can sync them with your email clients using CardDAV links. Head to the 'Contacts' section in OwnCloud, click the gears icon at the bottom, hover over the name of the address book you imported and click the 'Chain' icon. This spits out a CardDAV link for this address book that you can feed to your desktop or mobile address book client.



F



G

9 SYNC AND SHARE YOUR CALENDAR

Similarly, you can use OwnCloud to manage your calendar and tasks. To create an event in your calendar, head over to the Calendar app. You can view the calendar for the entire month or for the current week. To add a new event, click the appropriate date in the calendar. This brings up a window, which gives you several options to configure the event. To import an existing client, simply upload the .ical file to your cloud server. When you click the file in OwnCloud's web interface, the server recognises the file and offers to import it into an existing calendar or into a new one. Select the option that best suits you.

›› After you've imported the calendar, you can use OwnCloud to share it with other users. Click the 'Share Calendar' icon corresponding to the calendar you wish to share. This brings up a pull-down menu, which enables you to select the users or the group of users you wish to share the calendar with. Furthermore, just like address books, OwnCloud can also sync your calendars with desktop and mobile apps that can read this information from CalDAV links. To get the CalDAV link for your calendar, click the 'Gears' button and then the 'Chain' icon corresponding to the calendar you wish to sync. This displays the link that you can pass on to the clients to keep them in sync with the OwnCloud calendar.

›› There's a lot more you can do with OwnCloud. Explore the 'Apps' menus to find other ways to flesh out the default installation and extend the functionality of your cloud. In addition to the apps listed in the Apps section on your OwnCloud installation, there are others that you can install from the OwnCloud website. Scroll down the Apps section and click the 'More Apps…' link. This takes you to the OwnCloud store at http://apps.owncloud.com [Image G]. You can download any app from here and extract it under the '/var/www/owncloud/apps' folder inside the Pi. ■

UNIVERSAL ACCESS

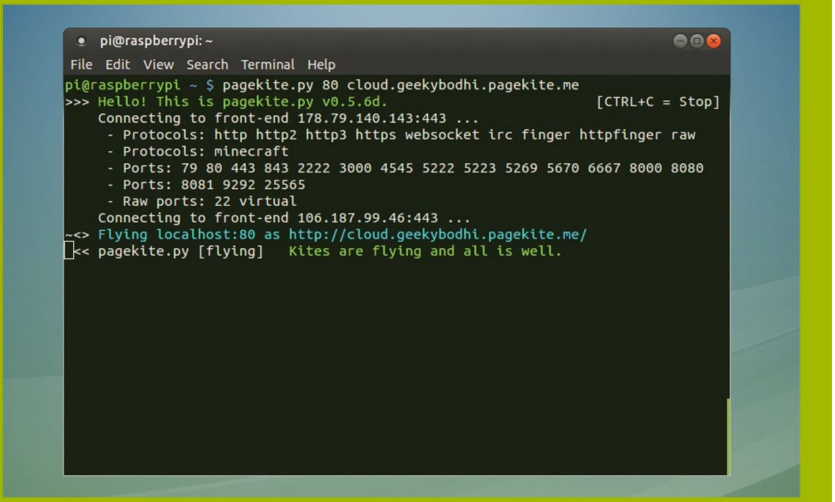
The real advantage of commercial cloud services such as Dropbox is that you can access data stored within them from any computer connected to the internet. However, by default, a self-hosted OwnCloud installation is only accessible from computers and devices that are within the local network.

That's not to say that you can't access your private cloud from the internet. The trickier and expensive solution is to get a static IP address from your ISP and then poke holes in your router's firewall. Or, you can set up Dynamic DNS in your router or local machine.

The smarter way, however, is to use a tunnelling service, such as PageKite. The service uses a pay-what-you-want model. As a non-commercial user, you can use the service for free by filling out a form once a month, telling PageKite how you use the service. But if that sounds like too much hassle, it's definitely worth the $3 per month minimum it requests from individuals.

First, you need to install PageKite. Launch a terminal and enter:

```
$ curl -s https://pagekite.net/pk/ | sudo bash
```



```
pi@raspberrypi ~ $ pagekite.py 80 cloud.geekybodhi.pagekite.me
>>> Hello! This is pagekite.py v0.5.6d.                             [CTRL+C = Stop]
    Connecting to front-end 178.79.140.143:443 ...
     - Protocols: http http2 http3 https websocket irc finger httpfinger raw
     - Protocols: minecraft
     - Ports: 79 80 443 843 2222 3000 4545 5222 5223 5269 5670 6667 8000 8080
     - Ports: 8081 9292 25565
     - Raw ports: 22 virtual
    Connecting to front-end 106.187.99.46:443 ...
~<> Flying localhost:80 as http://cloud.geekybodhi.pagekite.me/
 << pagekite.py [flying]   Kites are flying and all is well.
```

PageKite is certainly worth the $3 per month minimum fee.

When it's done, make your local web server public by entering the following command:

```
$ pagekite.py 80 mycloudserver.pagekite.me
```

Also, remember to replace 'mycloudserver' with the name you want for your OwnCloud server. Now you can access your own personal OwnCloud instance by heading over to http://mycloudserver.pagekite.me from any computer, anywhere in the world.

The first time you run this command, PageKite runs you through its brief sign-up process and will ask you for your email address.

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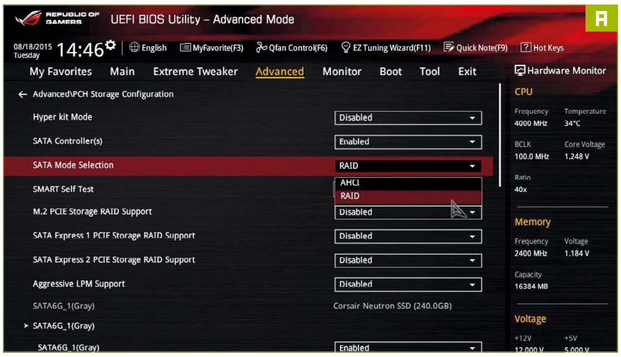
RAID Your SSDs for More Speed

YOU'LL NEED THIS

TWO SSDs
They need to have identical capacity. Also, a motherboard that supports RAID 0.

ONCE UPON A TIME, RAID 0 used to be a dirty word. An infamous acronym associated with corrupt OS drives and little gain. A lot has changed since the days of HDDs, however, and today it's an effective way of gaining PCIe-like storage speeds from 2.5-inch SSDs. RAID, or Redundant Array of Independent Disks, is a way of taking multiple disks and configuring them to provide a diverse and great deal of utility to the PC enthusiast. Here, we'll be visiting RAID 0, also known as data striping. The principle is simple: Take a couple of identical SSDs, split up the data between them, then read and write the data from both drives at the same time. –ZAK STOREY



Advanced\PCH Storage Configuration
Hyper kit Mode: Disabled
SATA Controller(s): Enabled
SATA Mode Selection: RAID
SMART Self Test
M.2 PCIE Storage RAID Support: Disabled
SATA Express 1 PCIE Storage RAID Support: Disabled
SATA Express 2 PCIE Storage RAID Support: Disabled
Aggressive LPM Support: Disabled
SATA6G_1(Gray): Corsair Neutron SSD (240.0GB)
SATA6G_1(Gray)
SATA6G_1(Gray): Enabled

CPU
Frequency 4000 MHz
Temperature 34°C
BCLK 100.0 MHz
Core Voltage 1.248 V
Ratio 40x

Memory
Frequency 2400 MHz
Voltage 1.184 V
Capacity 16384 MB

Voltage
+12V 12.000 V
+5V 5.000 V

1 FORMAT YOUR DRIVES

If you're planning on utilising this as an operating system drive, you'll need to have both drives already completely formatted. You cannot create a RAID array within Windows for your OS drive, without cloning the OS onto an additional hard drive and then formatting and copying it back across. To format your drives, boot into a Windows media disk, select 'Install', Custom installation', then 'Format', and delete all partitions on both of your drives.

2 FIND YOUR PORTS

Once formatted, you need to make sure your SSDs are plugged into the correct RAID 0-compatible SATA ports on your mobo. Refer to your manual, but these will be under chipset settings, usually the far right-hand side, closest to your RAM.

3 CHANGE STORAGE TYPE

Next, head into the BIOS [Image A]. Annoyingly, this step will vary depending on your motherboard manufacturer, but you need to find 'Storage Configuration' in advanced setup. At this point, change the storage type from 'AHCI' to 'RAID', then save changes and reboot.

4 CREATE RAID VOLUME

Hit [Control]–[I] to get into the Intel Rapid Storage Technology driver. Once in, you should see an in-depth Intel user interface. At the top, you'll have six options. Select the first: 'Create RAID Volume'.

5 STRIP SIZE

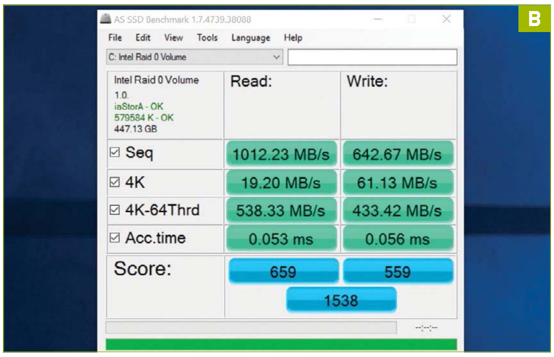
Now, give your RAID array a name. Hit [Tab] and make sure 'RAID 0' is selected. You can select another array here, but for the time being, you'll get the most performance gains from data striping. Hit [Tab] again to reach disk selection. If you have more than two drives running, you'll be asked to select which disks you want to RAID. However, if you're only running two, this should be blanked out. Next, choose the 'Strip Size', using the arrow keys. We want 128KB for RAID 0. Finalise your capacity and select 'Create Volume'. You're all set.

6 DRIVE TIME

Return to the BIOS and change your first boot option to 'USB stick', and install a clean version of Windows (or Linux, for you hipsters) onto your new lightning-quick RAID 0 array. Once you're all set up, you want to make sure you have all the SATA drivers and rapid storage drivers installed. Download the latest ones from your motherboard manufacturer's website. Then you want to grab the ATTO and AS SSD benchmarks.

7 PASS THE TEST

Run a few benchmarks [Image B] and see how you do. Make sure you select the main RAID array every time (it should be 'C') and you should see numbers close to ours [SSD Benchmarks], or even faster, depending on what drives you're using, or if you're utilising three or more. Now, sit back, relax and enjoy your super-fast transfer speeds and boot times. Once you get past that pesky Intel RAID check first, of course. ■



```
C: Intel Raid 0 Volume

Intel Raid 0 Volume   Read:          Write:
1.0.
iaStorA - OK
579584 K - OK
447.13 GB
☑ Seq                 1012.23 MB/s   642.67 MB/s
☑ 4K                  19.20 MB/s     61.13 MB/s
☑ 4K-64Thrd           538.33 MB/s    433.42 MB/s
☑ Acc.time            0.053 ms       0.056 ms
Score:                659            559
                              1538
                                           --:--:--
```

SSD BENCHMARKS

	Before RAID	After RAID
ATTO SSD read (MB/s)	558	**1,099**
ATTO SSD write (MB/s)	537	**746**
AS SSD sequential read (MB/s)	500	**1,012**
AS SSD sequential write (MB/s)	481	**643**
30GB folder transfer (secs)	**135**	150
5GB file compression (secs)	131	**128**

Best scores are bolded. Tests were carried out on 2x Kingston HyperX Savage 240GB SSDs, an Asus RoG Z170 Hero Motherboard and a stock-clocked Core i7-6700K, with 16GB DDR4 at 2,400MHz.

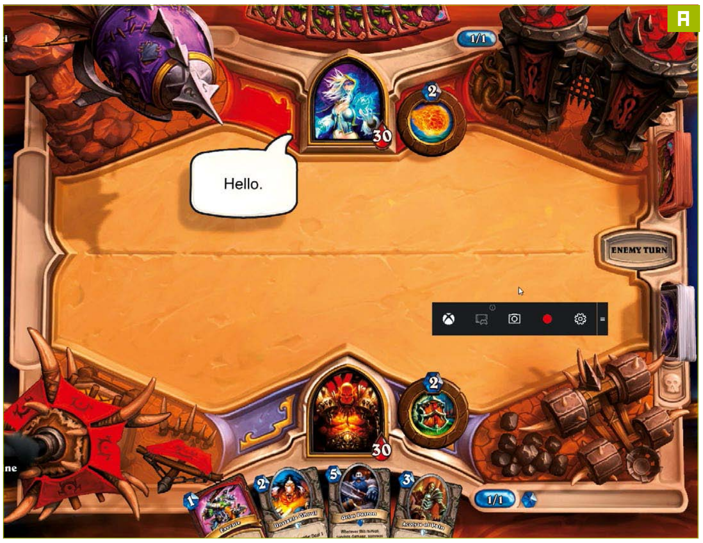
Record your Screen on Windows 10

YOU'LL NEED THIS

WINDOWS 10
Get the latest OS from www.microsoft.com.

BEING ABLE TO RECORD your screen can be helpful if you want to demonstrate to someone how a tricky thing is done in Photoshop, or show off your ungodly gaming skills on YouTube. Either way, up until now it's involved installing a third-party tool and then fiddling with it until it works. With the advent of Windows 10, however, Microsoft has bundled in a screen-recording app as part of its Xbox integration features. It's clearly meant for use when gaming, but oddly enough, it works with any desktop app – as long as you tell Windows that it's a game.

There's a simple keyboard shortcut to bring up the Xbox app and start recording. Microsoft hasn't officially announced this feature, so there's a chance it could be modified or patched away with a future update, but it works fine for now. –IAN EVENDEN



1 PREPARATION

Unless you happen to get lucky and catch your boss slipping on a banana skin and into a burning patch of stinging nettles, the best videos tend to be planned in advance. Write out a running order for your video on a piece of paper, keep it out of shot, and rehearse a few times. If you're capturing game footage, think about what you want your capture to show. Equip the items you need, pause the game, then unpause it after you begin recording – you can trim the footage later.

2 THE GAME BAR

It's not somewhere you'd go for an anonymous liaison with a woodcock, but a provided Windows screen overlay that's meant to record Xbox One apps being streamed to your PC. Open it with [Windows]–[G]. It's worth doing this at least once before recording as it comes up more slowly the first time.

3 GET TO KNOW THE CONTROLS

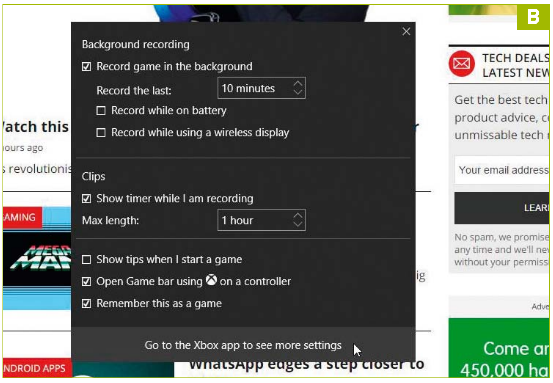
The Game Bar is fairly straightforward, with a red recording button that's just begging to be pressed [Image A]. There are four others though – the Xbox logo opens the Xbox app; the next – 'Record That' – turns on background recording; then there's the camera button, which takes a screenshot; and the 'Record' button itself. The cogwheel opens up the settings [Image B].

4 SETTINGS

The app only captures the currently active window, so it's worth having it maximised or in a borderless window mode if you want it to fill a 16:9 screen on playback. Most settings are in the Xbox app, under 'Game DVR', but the Game Bar has a few, too, including whether it should remember that the current app is a game.

5 YES, MY BROWSER IS A GAME

It sounds crazy, but the Game Bar really does ask if your current application is a game when it launches [Image C]. It also trusts you completely – Chrome, Photoshop and Word all become games if you tick the



Background recording
☑ Record game in the background
Record the last: 10 minutes
☐ Record while on battery
☐ Record while using a wireless display

Clips
☑ Show timer while I am recording
Max length: 1 hour

☐ Show tips when I start a game
☑ Open Game bar using Ⓧ on a controller
☑ Remember this as a game

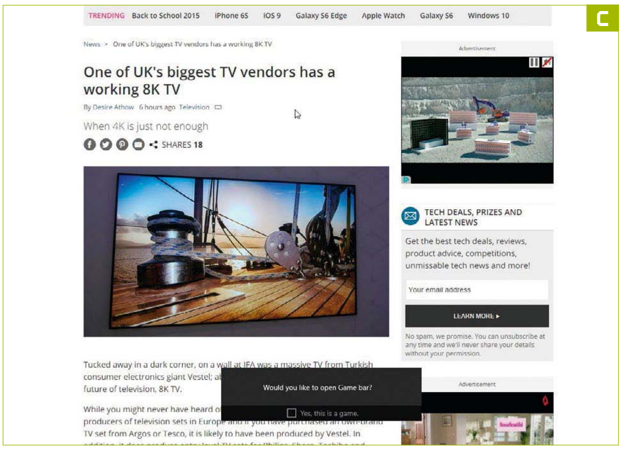
Go to the Xbox app to see more settings

WINDOWS MOVIE MAKER

Windows 10 doesn't have a built-in video editing app, and the Store is rather lightly populated by them.

However, you don't have to shell out on a brand new copy of Adobe Premiere Elements (unless you really want to; it's a fine application) as the Windows 8 version of Movie Maker is still available for free and works with Windows 10. Head to http://bit.ly/1oiRnLg and click the top option to begin the download.

Simply install it as usual, though you probably won't want the other applications bundled with it, such as the defunct Microsoft Messenger. Alternatively, if you upload your raw clips to YouTube but don't publish them, you can still use http://bit.ly/ZLeWqp to knock your videos into shape, creating a new movie from them that you can then happily publish.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One of UK's biggest TV vendors has a working 8K TV

By Desire Athow 6 hours ago Television

When 4K is just not enough

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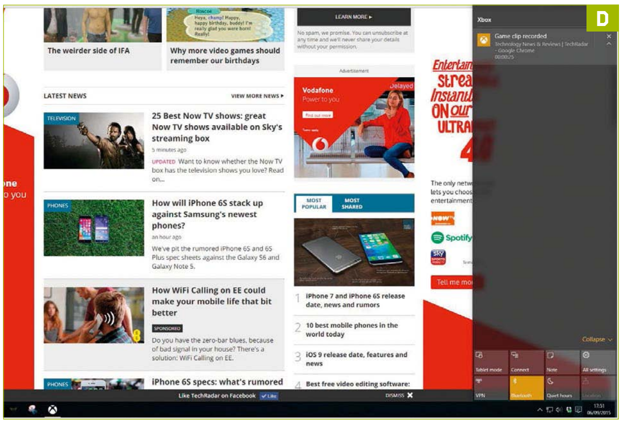
Tucked away in a dark corner, on a wall at IFA was a massive TV from Turkish consumer electronics giant Vestel; al… future of television, 8K TV.

While you might never have heard o… producers of television sets in Europe… TV set from Argos or Tesco, it is likely to have been produced by Vestel. In

Would you like to open Game bar?

☐ Yes, this is a game.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Xbox
Game clip recorded
Technology News & Reviews | TechRadar - Google Chrome
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MOST POPULAR
MOST SHARED
Collapse
Tablet mode
Connect
Note
All settings
VPN
Bluetooth
Quiet hours
Location
Like TechRadar on Facebook
DISMISS
17:51
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The weirder side of IFA

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4 Best free video editing software:

box. From the settings icon on the bar, you'll be able to tell it to remember that your selected app is a game, so it won't ask again. Once this is done, the bar opens as normal.

6 START RECORDING

Hit the red record button and the screen capture begins. A red marker appears in the top corner of your window with a counter to see how long you've been going. Click the arrow on this and it'll disappear, but it doesn't appear on the final video so can be safely left there. When you want to stop recording, press [Windows]–[G] again and the bar will reappear, with a 'Stop' button next to its counter.

7 GET NOTIFIED

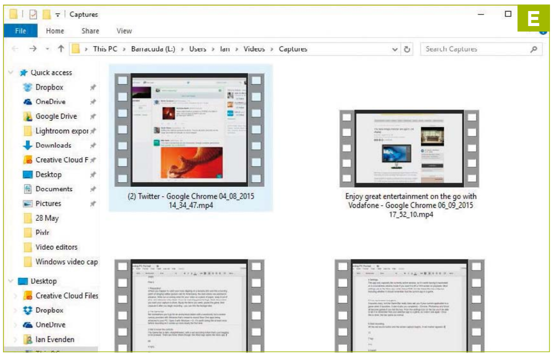
When you stop, you'll get a notification in the bottom-right of the screen that your video has been saved. Click this and you'll be taken to the Xbox app, where a list of all your videos can be found [Image D]. There are a few options on this screen. You can rename your file, trim it and play it back, but unless you captured from a game, the Xbox app recognises the 'Share' button won't work, as it's sharing to Xbox Live rather than Twitter, and Live is a games-only zone. To share the old-fashioned way, use the 'Open Folder' button to get at the file [Image E].

8 MORE SETTINGS

There are a few quality settings in the Xbox app, which affect not just the quality of the saved video, but also the strain its capture puts on your PC. If you're having trouble maintaining a playable frame rate while capturing (this is less of a problem when capturing from non-game apps), then turning down the quality can help you out. We tested the quality levels, and didn't notice a huge difference when uploaded to YouTube.

9 BACKGROUND CAPTURE

A little like Nvidia's Shadowplay, this makes a user-defined amount of game time – from 15 seconds to 10 minutes – available for capture. Take a tour of Mother Base or pull off an outrageous takedown, and you can save it with a keystroke to share later – hit [Win]–[Alt]–[G], but you need to have enabled it first in Xbox app settings and switched it on with the Game Bar.


E
Captures
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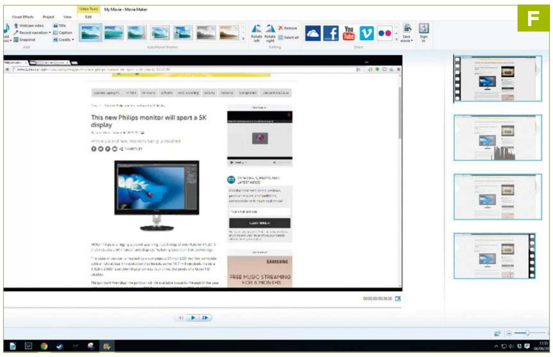
View
This PC > Barracuda (L:) > Users > Ian > Videos > Captures
Search Captures
Quick access
Dropbox
OneDrive
Google Drive
Lightroom expor
Downloads
Creative Cloud F
Desktop
Documents
Pictures
28 May
Pixlr
Video editors
Windows video cap
Desktop
Creative Cloud Files
Dropbox
OneDrive
Ian Evenden
(2) Twitter - Google Chrome 04_08_2015 14_34_47.mp4
Enjoy great entertainment on the go with Vodafone - Google Chrome 06_09_2015 17_52_10.mp4

10 FILE HANDLING

The files produced by Game DVR are in MP4 format, but their resolution depends on the size of the window you had open when you started capturing [Image F]. If it was 1,036 pixels high, your video will be too, and some editing apps might have a problem with this – we tried it in Windows Movie Maker (see "Windows Movie Maker", opposite), however, and it was fine, adding black bars either side.

If you want to make sure you're capturing a full 1080p frame (or higher if you're fancy), you might want to use background capture in full screen mode. Check its settings to make sure it doesn't stop recording before you've finished. ■


F
This new Philips monitor will sport a 5K display

ALTERNATIVE SIMPLE RECORDING OPTIONS

1 SHADOWPLAY

Nvidia's recording option saves the last 20 minutes of your gameplay, and needs to be turned on in the GeForce Experience app. It claims about a 5 per cent performance hit, and works up to 4K resolutions. AMD users can use the AMD Gaming Evolved app in a similar way.

2 EZVID

A free screen recorder and basic editor, EZvid can record games as long as they're running in windowed mode – it captures the entire screen, so any app can be recorded. You can also use it to make a slideshow from stills, useful for tutorial videos.

3 CAMSTUDIO

A recording app that's full of options – hide or reveal the mouse pointer, record program sounds, record voiceover from a mic and so on. It'll save your captures as an AVI file, and convert them to a Flash video if you really want it to.

ASK LUIS

BY LUIS VILLAZON

All The Stuff You Didn't Know About

Have *you* upgraded to Windows 10 yet?

RAINBOW CHASING

JOIN THE DIGITAL QUEUE

I want to upgrade to Windows 10 (I'm currently on 8.1). I ignored all the stuff about 'reserving' my copy because I just assumed I'd be able to download it on July 29. But when that day came around, I clicked on the little icon at the bottom of the screen and it still told me I needed to reserve my copy and Microsoft would 'let me know' when it was ready. That was yesterday. What's the hold up? Did I mess up by not reserving it earlier?
Anthony German

Good question, I actually tested this myself. I bought a new laptop a few weeks before Windows 10 launched and reserved my copy on it immediately. But I waited until release day to do the same on my Windows 8.1 desktop, just to see what the difference was.

You aren't actually reserving anything either way, of course. These are digital downloads; there is nothing to reserve because Microsoft can't run out. What you're really doing is putting yourself in a sort of loose queue that allows Microsoft to keep an eye on the amount of bandwidth being swallowed up as a few hundred million Windows 7 and 8 users all try and download 3GB each. If you wanted to get Windows 10 on release day, then yes, you messed up. By 'reserving', you let Microsoft pre-download a lot of the files using the automatic updates mechanism and a full install took about 30 minutes on my laptop. The desktop took over a week to get the green light to proceed and the download took about an hour.

By the time you read this, I imagine that most of the initial rush will have died down and you'll already have upgraded. But if you have any other machines that you haven't upgraded yet and you want to jump the queue, you can download the ISO disk image file directly at www.microsoft.com/en-us/software-download/windows10ISO. You can upgrade directly on the PC that performs the download, but there's also an option to copy it to a DVD-R disc or USB drive. Then you can use that to upgrade to Windows 10 on lots of PCs without downloading it again each time. Just like the old days.

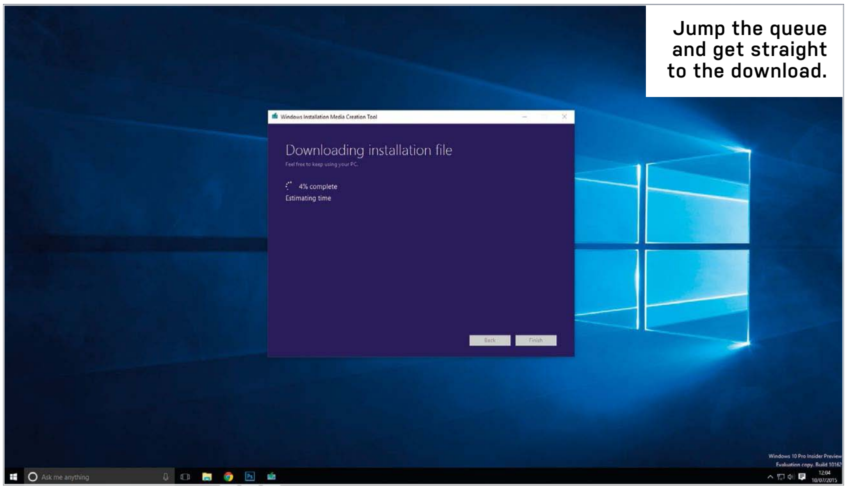
OMINOUS PORTENTS

A FRESH START

I've been using Windows 8.1 nearly since it came out and I've always suspected, but never been able to prove, that I had some viruses or other stuff installed there. Nothing I've tried seems to have got rid of it, including reinstalling. So, I'm wondering if Windows 10 might prove to be my salvation. Will the upgrade process clear everything out, including my viruses? Are there even viruses available for Windows 10 yet?
Micha Mansur

You know why you can't prove these viruses are there? Because they aren't. You can't cry virus every time your PC runs slowly, or crashes, or doesn't do what you want. That's the procedure for detecting witches. If you think you have a virus, you boot into Safe Mode and run a free online scanner, like housecall.trendmicro.com. If that comes up clean, you don't have a virus. If you ignore the results of the virus scan and trust your 'suspicion' instead, then you have allowed madness to take root.

If you *did* have a virus under Win8.1, upgrading to Win10 almost certainly wouldn't get rid of it. The upgrade process leaves your documents and applications alone and virtually all Win8 executables will also run under Win10,



Downloading installation file
Feel free to keep using your PC.
4% complete
Estimating time

Jump the queue and get straight to the download.

FREE TECHNICAL SUPPORT

Email Luis for guaranteed insults and possibly even some technical help as well.

pcfhelpline@futurenet.com
PCF Helpline, Quay House,
The Ambury, Bath BA1 1UA

The six categories of all human misery

REPRODUCIBLE CALAMITY
Things that break predictably.

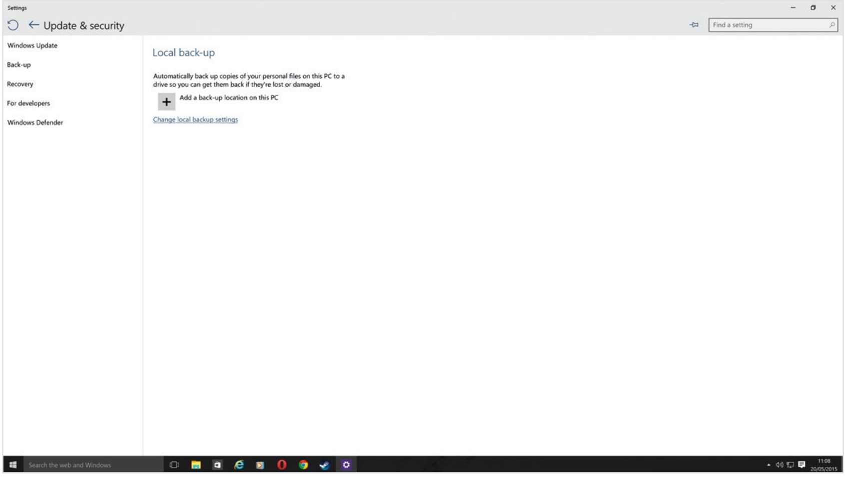
RANDOM WEIRDNESS
Things that break unpredictably.

CREEPING BADNESS
Things that just get worse.

OMINOUS PORTENTS
Things that might be a problem.

SPONTANEOUS BREAKAGE
Things that definitely are.

RAINBOW CHASING
Things that could be so much better.



Local back-up

Automatically back up copies of your personal files on this PC to a drive so you can get them back if they're lost or damaged.

Add a back-up location on this PC

Change local backup settings

Backing up your PC: Do it and do it now. Otherwise, you'll get no sympathy here.

so any infected files on your old system would be free to run the virus code on the new system. I don't think there are any viruses or malware that specifically exploit Win10 yet, but a lot of the Win8 malware catalogue should still work. It's lucky you don't have any of them, isn't it?

SPONTANEOUS BREAKAGE

PLUNGED INTO DARKNESS

I upgraded to Windows 10 from Win 7 recently and the screen went completely black after the first reboot. It came back briefly during one of the other reboots in the upgrade process, but then it went black again and stayed that way. Stupidly, I didn't back up before I began the update, so I can't just roll back. I have tried swapping the monitor and that makes no difference. I've also tried hitting [F8] to get Safe Mode but that doesn't seem to work either. What are my options at this point? Can I complain to Microsoft about this? Surely it is their fault?
Matt J

It's partly their fault for not having tested Windows 10 on the particular graphics card and driver combo you are using. But it's mostly your fault for not backing up. Forgetting to backup just before you upgrade, is forgivable – we're all human, and prey to human folly; sometimes the excitement of a new upgrade gets the better of us, I get that. But not having *any* backup to fall back on is inexcusable. I have no more sympathy for people who don't back up their PCs than I have for uninsured drivers. Seriously, you people are the worst.

If you had a valid backup, you could roll back to Windows 7 and enable Remote Desktop Protocol, run the Win10 upgrade again and then use RDP to connect to your blank-screen PC from another one and fix your graphics driver problem. You can't boot into Safe Mode from Windows, because you can't see what you're doing and most modern PCs with UEFI BIOSes and SSDs boot much too quickly to detect the [F8] keypress. Which means you'll have to temporarily install an alternative cheapo graphics card just to give you some eyes on the ground. Then you can go to Nvidia or AMD and download updated drivers that work with Windows 10.

> “YOU CAN'T CRY VIRUS EVERY TIME YOUR PC CRASHES OR DOESN'T DO WHAT YOU WANT.”

CREEPING BADNESS

WHERE'S MY FREE UPGRADE!?

I signed up for the Windows 10 preview scheme so that I would be eligible for a free upgrade when it was released. It now seems that Microsoft has changed its mind about this and I am not eligible for a full version. So, if I ever need to reinstall after a hard disk crash or something I am out of luck? WTF Microsoft!? What am I supposed to do now? Go back to XP? Is that really my only option?
Cristo

I'd say that's the least preferred option, for all parties. The free upgrade to Win10 only applies if you are upgrading from Win7 or 8. At one time Microsoft suggested that older versions might be eligible, too, but it looks like it changed its mind because older hardware doesn't run Win10 very well anyway. So, what Microsoft actually wants you to do is to buy a new PC with Win10 on it. That would be my advice, too. You could also just pony up for a new copy of Win10 for

YOU ASKED!

FAQ

Audiophile Ethernet Cable

What is this?
A higher-spec cable designed to improve digital audio streamed from your NAS to your router, or your router to your PC.

Does it work?
No.

How is it different?
It varies. Some use higher-spec components but are otherwise ordinary Ethernet cables. Others use silver-plated copper wire.

Does that make any difference?
No.

Don't higher quality cables introduce less noise?
They do, but the Ethernet protocol is designed to operate in a noisy environment. The protocols that sit on top, like TCP/IP, add extra error correction. Network packets that don't make it through get retransmitted. Audio apps buffer the incoming packets, so there is time for a complete, error-free, stream of perfect data to travel through an imperfect medium.

So there's no advantage?
No.

Has anyone tested this?
The James Randi Educational Foundation. It compared a £225 AudioQuest Vodka Ethernet cable to a £1.60 cable from Amazon, to see if listeners could tell the difference. They couldn't.

But what about the science?
The placebo effect is undoubtedly real. Audiophiles get very real satisfaction from spending big on equipment, believing they're chasing a quality improvement. If the science doesn't support them, they invent new sources of ever-more subtle noise and new pseudo tech to overcome them.

Read more at:
http://bit.ly/1Ivq1tR

about £80. But you don't need to. You can stay part of the Windows Insider Program on your current hardware if you want. Microsoft has said these beta versions will be supported for the lifetime of your PC. You'll need to have a full backup of your hard disk in case you ever need to reinstall – but that, as I have said already this month, is true of all of us. Unlike an ordinary copy of Win10, the WIP install will continue to send usage telemetry back to Microsoft, but that should be invisible to you and the performance hit is minimal.

> "YOU DON'T HAVE AN I.T. DEPARTMENT. YOU JUST HAVE YOUR IDIOT FRIENDS."

OMINOUS PORTENTS

ARE UPDATES BAD?

I upgraded to Windows 10 on release day and so far it runs like a dream. But I'm concerned about this automatic updates thing. People have been telling me that it can't be turned off and some of my friends aren't upgrading because they say this could be a security risk, if one of the updates has a bug or a backdoor or something. Are they right?

If it is a risk, is there any way of disabling automatic updates? Can I just disconnect from the internet for a day or two whenever a new update comes out?

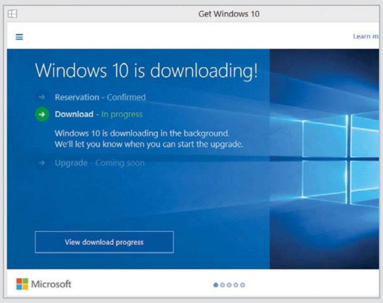
Gerry Hayne

Automatic updates are compulsory in the Home edition of Windows 10. Disconnecting the internet won't make you miss an update – it will just install as soon as you reconnect. If you have Windows 10 Pro, you can defer your updates for a few months, to give your IT department time to test it with your existing drivers. But you don't have an IT department, you just have your idiot friends who aren't upgrading in case someone hacks Microsoft and injects malware into their update code.

This is theoretically possible of course - there is very little that isn't *theoretically* possible when it comes to software – but it's a much, much lower risk than the risk of leaving automatic updates off. Security updates are released to patch *known* vulnerabilities. By definition, every day that you do not patch this hole is a day that you are vulnerable. It's like walking down the middle of a busy road, so you don't get hit by cyclists on the pavement. No Windows update has ever been released with malware in it, and the version of Windows with the least consistent update record (XP) is also the version most infected by malware. Forcing automatic updates will make Windows 10 the least-infected version and is the most important security advance since Microsoft started making updates available online at all.

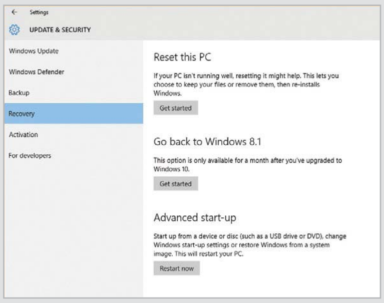
Downgrading Windows 10

Waking up next to a new OS



Windows 10 is downloading!

Windows 10 is downloading in the background.
We'll let you know when you can start the upgrade.



Reset this PC

If your PC isn't running well, resetting it might help. This lets you choose to keep your files or remove them, then re-installs Windows.

Go back to Windows 8.1

This option is only available for a month after you've upgraded to Windows 10.

Advanced start-up

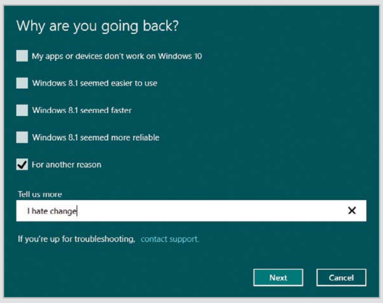
Start up from a device or disc (such as a USB drive or DVD), change Windows start-up settings or restore Windows from a system image. This will restart your PC.

1 Roll back

Let's be clear from the start: Windows 10 is better than Windows 8.1 and better than Windows 7. But if you upgrade and find you can't make it work with your PC, you have a one-month grace period during which you can roll back to your previous operating system.

2 Back up

If you've installed any apps since upgrading, these will be lost, so make sure you have backups. Then click 'Start → Settings → Update & Security → Recovery'. On the right, choose the middle option, labelled 'Go back to Windows 7' or 'Go Back to Windows 8.1'. Click 'Get Started'.

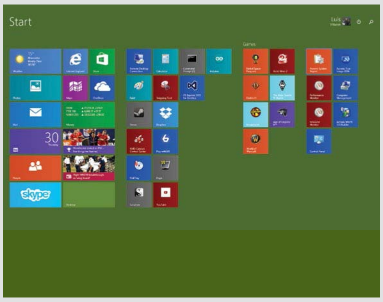


Why are you going back?

☐ My apps or devices don't work on Windows 10
☐ Windows 8.1 seemed easier to use
☐ Windows 8.1 seemed faster
☐ Windows 8.1 seemed more reliable
☑ For another reason

Tell us more: I hate change

If you're up for troubleshooting, contact support.



3 'Fess up

You need to pick a reason for downgrading, so Microsoft knows where it went wrong, and you'll get some warnings about lost settings etc. But the process itself is pretty painless. That's because when Win10 originally installed, it saved your old OS in a folder called 'Windows.old'.

4 Flip flop

And here you are, back with the Metro screen. Happy now? If you change your mind *again* you can just run the upgrade again from www.microsoft.com/en-us/software-download/windows10ISO. Or if you had made proper backups in the first place, you could restore from those.

REPRODUCIBLE CALAMITY

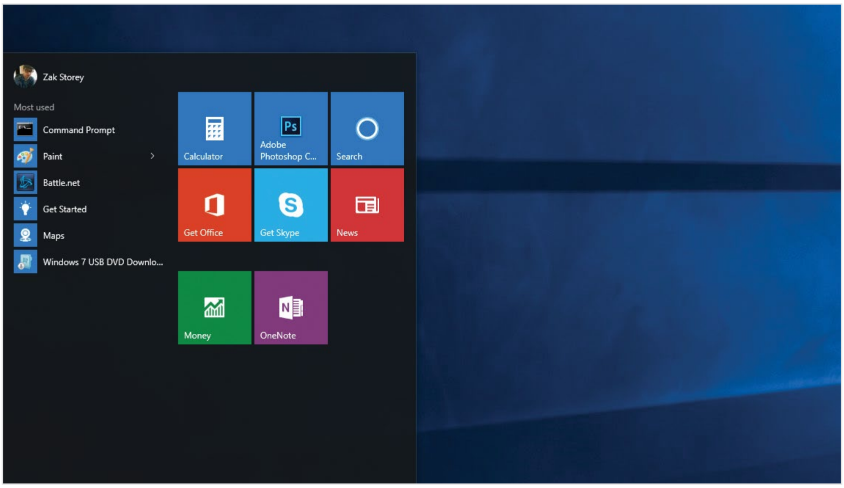
MORE LIKE THE 'STOP MENU'!

Is there a way to add any program to the Start menu? I'm sure I used to be able to do this but when I drag a file onto the Start menu, nothing happens. I read online that creating a shortcut in C:\ProgramData\Microsoft\Windows\Start Menu\Programs would do it, but this just gives me an error message. I'm using Windows 10.

Neil Pritchard

It sounds like you're not logged in as administrator. C:\ProgramData is for the system Start menu, which is global for all user accounts and you need to be administrator to write there. Even if you are administrator, some apps don't like launching from there. Try '%appdata%\Microsoft\Windows\Start Menu\Programs' instead. If you open a command prompt window, you can type "CD", followed by this path name and hit [Enter] to navigate there. Or else you can just use Windows Explorer to open C:\Users\←your user name→\AppData\Roaming, which is what the '%appdata%' normally expands to.

But really, this is tinkering around the edges. What you need to do is give yourself administrator access on your account. If it's your PC, you should normally be logged in as an administrator if you ever want to get anything done. Non-admin accounts are


Zak Storey
Most used
Command Prompt
Paint
Battle.net
Get Started
Maps
Windows 7 USB DVD Downlo...
Calculator
Adobe Photoshop C...
Search
Get Office
Get Skype
News
Money
OneNote

Head over to '%appdata%' to add programs to the Start menu.

for young children and house guests. If the PC isn't yours, tell your parent/spouse/housemate to stop being a control freak and give you a proper login. Or get your own PC and lock them out of it, if you prefer to escalate things.

RAINBOW CHASING
DEATH TO THE LOGIN SCREEN!

I've just upgraded to Windows 10 and generally I really like it but there's one thing I just can't stand – that terrible blue login screen. Is there any way to get rid of it?
Luke Presley

Yes, you can at log in. That only lasts until the next time you log out though, which might not be long enough for you. For a more permanent solution, you can edit HKLM\SOFTWARE\Policies\Microsoft\Windows\System and add a new DWORD value called 'DisableLogonBackgroundImage', set to '1'. Once you do that, you'll still get a login screen, but it will have a solid background colour, which you can change from the Personalisation settings (more on that in the next question). If you don't even want to log in at all, you can open 'netplwiz' (just type it into the search box on the Start menu) and untick the box marked 'Users must enter a user name and password to use this computer'.

But, before you race to throw away the login screen, I'd like you to watch this video – youtu.be/hL8BBOwupcI – and appreciate the fact that this image you can't stand, isn't just some simple digital line art with some glow effects added. Microsoft hired the guy that did the GFX for the *Oblivion* movie to take a photo of an actual window pane with lasers and stuff to make it *look* like simple digital line art with glow effects. In other words, that login screen was really, really expensive.

SPONTANEOUS BREAKAGE
EVERY. SINGLE. TIME

New to Windows 10. Where did Control Panel go?
Shane Orstwick

The same place Control Panel always goes every time there is a new version of Windows: into the nega-realms of shadow and confusion, hidden behind new and mysterious aliases and analogues. I've said many times before that Control Panel has the worst and least consistent interface design of any

15:11
Monday 24 August
Activate Windows
Go to Settings to activate Windows.

You can change the login screen if you hate it that much.

FLASHBACK

What Luis Said...

GEFORCE GTX 470 TESTED
IS THIS THE CARD YOU'VE BEEN WAITING FOR?
FREE DVD
GAMES 'N' TOOLS
PERFORMANCE GEAR & GAMING
PCFormat
EXCLUSIVE
FASTEST PC EVER!
ULTIMATE POWERHOUSE
CROSSFIRE 5870s
SIX-CORE CPU
86fps IN DiRT 2
NO.1 FOR GEAR
THE INSIDE SCOOP: WHY THE PC WILL KICK ASS THIS YEAR
San Fran's Games Developers Conference
3D DISPLAYS IN THE LABS
Do we need that extra dimension?
32 PAGES OF GAMES!
THERE'S MORE:
HAS WIN 7 KILLED OFF LINUX?
BECOME AN AUDIO GOD!
ROUND-UP FAST PENDRIVES
MASS EFFECT 2 SECRETS REVEALED
PLAIN SIGHT BRITISH INDIE SMASH!
techradar.com
Future

5 years ago *(PCF240)*

About troubleshooting

It's a graphics driver issue. I know that's the most boring answer in the world for a PC question. Sometimes it feels like *every* PC problem is a graphics driver issue. But that's just because graphics drivers have a lot of issues.

10 years ago *(PCF179)*

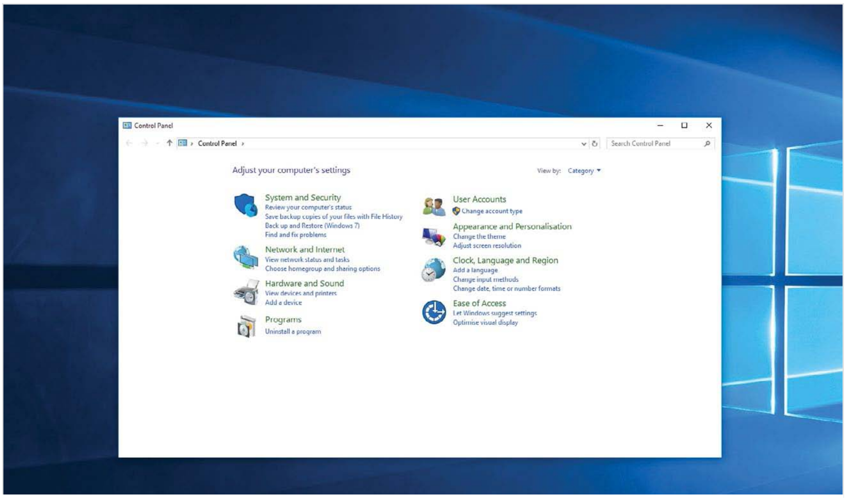
About junk mail

Spam is the inevitable consequence of connecting gullible idiots and ruthless profiteers to the same communication system. All of the proposed solutions to spam – whether they use clever filters or blacklists or whitelists or digital signatures or pentagrams and magic runes inscribed on your USB modem – fail because they do not tackle the fundamental point. The easiest way to find an idiot prepared to take out an internet mortgage for a property in Manhattan that he doesn't own is to email everyone in the world until someone replies.

20 years ago *(PCF48)*

About usable RAM

In practice, you would be mad to want to install 256MB of RAM in a DX2/50. For one thing, there's no PC software that could make use of this much RAM. For another, it would cost around £6,800. If you're really prepared to spend this much dosh, what's another £100 for a new motherboard? I honestly think that 32MB will be all you will ever need for a long time to come.


Control Panel
Control Panel
Search Control Panel
Adjust your computer's settings
View by: Category
System and Security
Review your computer's status
Save backup copies of your files with File History
Back up and Restore (Windows 7)
Find and fix problems
Network and Internet
View network status and tasks
Choose homegroup and sharing options
Hardware and Sound
View devices and printers
Add a device
Programs
Uninstall a program
User Accounts
Change account type
Appearance and Personalisation
Change the theme
Adjust screen resolution
Clock, Language and Region
Add a language
Change input methods
Change date, time or number formats
Ease of Access
Let Windows suggest settings
Optimise visual display

The Control Panel – slightly improved for Windows 10, but still terribly designed.

part of Windows and that's still true in Windows 10. In fairness, Win10 has slightly improved the situation over Win8, but as usual, it has achieved this with a new layer that stands between us and the Control Panel we actually need, without doing anything to make this underlying layer easier to use.

The new layer is Settings, which you can reach from the Start menu directly. It has a pared-down interface with icons for the most common options, which are easy to tap on a touch screen. That's good. You can still open the old Control Panel by searching for it on the Start menu, and I guess that's good, too. But there's no direct correspondence between Settings and Control Panel. Which drives me nuts! Neither is a direct subset of the other. They just have overlapping, ill-defined jurisdictions that mean you are never sure which one you should be opening to customise a particular feature. And that's assuming it's a feature that is actually exposed to either one, and not a ninja customisation that requires a registry edit.

I used to hope that with each new version, Control Panel would just burn to the ground, since it's horrible. But all that ever seems to happen is that the roof sags a bit more and Microsoft builds a new lean-to extension on the side. Or pinches some of the ornamental stonework for the new front porch.

REPRODUCIBLE CALAMITY

WHEN IS SIX LESS THAN TWO?

I would like to take advantage of my free upgrade to Windows 10. I registered for the upgrade, like a good little customer, but on release day I was told I don't have enough RAM on my PC. The trouble is, I do! I have 6GB currently installed and Windows says it needs at least 2GB. What can I do? Would adding more RAM help?

Sadif Bakri

I actually think that a better tactic might be to remove some. I've seen this situation a couple of times now. The 'Get Windows 10' app isn't perfect and sometimes it misidentifies the amount of installed RAM. This might be because of an odd RAM configuration or maybe you have some software running that is somehow masking how much the rest of Windows can see. It's also possible, of course, that one of your RAM modules is faulty and you do in fact only have 2GB of physical RAM. But assuming you can reboot with just the 4GB module, this might shake things up enough to let you upgrade.

Get Windows 10 isn't a first-come-first-served queue though. It also takes into account compatibility. So, if your PC is old or unusual and you also hobble it by leaving it with only just enough RAM, you might find that you don't get an invitation to upgrade for a few weeks more. If you can't be bothered to wait, just run the installer directly from www.microsoft.com/en-us/software-download/windows10ISO.

RAINBOW CHASING

WE ALL SCREAM FOR WIDE SCREEN

Who chooses which resolutions make it to the standard list of screen sizes that Windows and monitors accept? Why is it 1280 x 1024 for instance, and not 1200 x 1000, or 1500 x 1100? Why is 1366 x 768 still common in Windows 10 laptops? It's not a multiple of anything in either direction and 683:384 is hardly a standard aspect ratio!

Glyn Janner

Oh, come come! I think you are being disingenuous. Okay, 1366 x 768 is actually 16.008:9, which is actually only off from the standard 16:9 widescreen resolution of 16:9 by less than 0.05 per cent. In other words, it's the closest even-numbered horizontal resolution that converts a 1024 x 768 resolution into widescreen.

Why 768 vertical pixels, you ask? Ah, well, it's all perfectly logical. In the beginning there was CGA resolution, which was 320 x 200. This was horrible and didn't fit properly on 4:3 aspect ratio TVs, so they doubled it horizontally and slightly-more-than-doubled it vertically to produce VGA, which was less horrible, and did. If you double that in both directions again, you'd get 1280 x 960 but this requires more than 1Mb of screen buffer. By the time graphics cards got good enough to do that, we were watching TV on widescreen. It's much easier to downscale 1080p HD to 1366 x 768 because they are both 16:9 aspect ratios. And if you need 4:3 resolution, you can stick some black bars on the side and call it 1024 x 768.

In fact, the odd one out here is really 1280 x 1024, not 1366 x 768, as 1280 x 1024 (or SXGA, as it's referred to by virtually no one) is the only 5:4 aspect ratio screen resolution, which means it doesn't display well on just about any modern screen. I think the only reason it lasted so long is that 1,024 is a round number in binary and is therefore easy for chip designers to address. ■

STATS KNOW-IT-ALL?

Quiz

1. How many characters are there in the current Unicode standard?
a) 120
b) 1,200
c) 12,000
d) 120,000

2. Which of these encodings is obsolete?
a) UCS-2
b) UTF-8
c) UTF-16
d) They're all current

3. When was the Unicode character set first proposed?
a) 1972
b) 1987
c) 1994
d) 2003

4. How many bits can a UTF-8 character contain?
a) 8
b) 16
c) 24
d) 32

5. Which of these four ranges of characters is not currently included in the Unicode standard?
a) Mahjong tiles
b) Alchemical symbols
c) Food allergy symbols
d) Byzantine musical symbols

Answers: 1d 2a 3b 4d 5c (though it's under review)

DISCOVER THE FUTURE OF AUTO TECH IN TODAY'S CONNECTED WORLD

ONLINE • PRINT • TABLET

APPLE WATCH
Pre-condition and open your car

BMW i3
The compact electric vehicle to die for

LIFE'S BETTER WITH T3

t3.com

Month in numbers…

85,391,869

The number of vaults created in post-apocalyptic spin-off game *Fallout Shelter*. Apparently, it's enough to house the entire population of the US. We're wondering if developer Bethesda knows something we don't.

28.2%

Of Americans cite 'action' as their favourite game genre, according to Forbes. But what is an 'action' game? All games involve some sort of action, right? If not, they'd just be a series of pictures. Like *CoD*.

15,000

The number of citizens recently arrested in China under new internet laws. Crimes committed include sabotage attacks, intrusion control sites, online banking trojan theft and banana endangerment. Admittedly, Google Translate might be letting us down on that last one.

16TB

The capacity of Samsung's latest giant SSD drive. The PM1663a uses the company's proprietary 3D vertical NAND flash chips to pack in those terabytes. Forget slapping it in your desktop and filling it with Steam games, though – it's aimed squarely at the data centre market.

27 million

The number of installs of Windows 10 recorded in its first two weeks of release, according to StatCounter. It took Win8 six months to reach that installation base. We're guessing it's because Win10 is free, and it doesn't make you want to repeatedly smack your head against a metal spike.

ILLUSTRATION: KEVIN FEBRUARY

THE VOICE OF REASON

Nuclear Fallout

PC *Format* has a mole. A man wedged inside the games industry's nether regions. A man rendered so hideously paranoid by a life spent playing sub-standard PS2 ports that he won't even let us edit his copy. These are his troubled thoughts…

DESPITE REPEATED THREATS, the folks at Bethesda have refused to give us an inkling on *Fallout 4*'s story. The post-apocalyptic sequel's narrative thrust is to remain tightly under wraps until the game's release in November. It's a brave move in an age when every single aspect of every single game is known and documented on YouTube about a decade before a title's release.

Nevertheless, we here on *Format* hear things. Not just the voices in our heads that tell us to fling mouldy peanut butter at passing strangers, but the actual real voices we hear at various games industry events, conventions and dogging sessions. And we've heard a lot about *Fallout 4*. So much so that we've managed to piece together all the tidbits into a pretty decent idea of the game's top secret storyline.

Even Wikipedia knows that *Fallout 4* will be set in 2277, 200 years after the Great War and roughly in the same time period as *Fallout 3*. It's going to take place in Boston, and like *Fallouts 3* and *New Vegas*, it will gently homage and parody the history and famous people of the area.

It begins with a recreation of the Boston Tea Party, which is famous for being the most disappointing party ever. In 1773, a bunch of guys calling themselves the Sons of Liberty dumped a load of tea in Boston Harbour to offend the English. As an Englishman, I can attest that this is the most offensive thing anyone can do, aside from hanging the Union flag upside down or not personally knowing the Queen.

Of course, this being *Fallout*, the Boston Tea Party is slightly skewed. In game it's referred to as the Boston Nuclear Party, and the Sons of Liberty are renamed the Sons of Nuclear. Instead of tea, it's nuclear tea that is dumped in the Boston harbour. The English are called the Nuclear English.

This is where the player character steps in. Named Samuel "Nuclear" Adams, after the famous Boston beer, he's taken aside by Ted Danson from *Cheers* and his pal RoboCoach, who instruct him on the ways of the wasteland. Adams's quest is to find a giant nuclear teapot so the two bitter rivals can sit down and work things out over a cup of nuclear tea and a nuclear scone.

It all goes a bit pear-shaped when Matt "Nuclear" Damon uses his wily working-class Bostonian charms and completely unsurprising intellect to construct a Deathclaw version of Minnie Driver. Her corkscrews of impalement are fuelled by nuclear tea, so Adams's final choice is between helping Nuclear Damon, the Nuclear English or the Sons of Nuclear.

Thing is, at this point no one could give a shit. Not even the tiniest little bit of shit. An amoeba shit. I can't recall *Fallout 3*'s story (something about Qui-Gon Jinn and some water?) or *New Vegas*'s (something about Chandler from *Friends* and some water?), because I was too busy trying to complete every side quest, level up and collect all the items. *Fallout 4* will be the same. So much so that we can make up any old garbage and people will believe it's the plot. ■

↘ So long, and thanks for all the fish!

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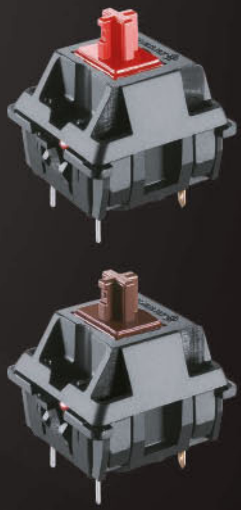

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